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AMERICAN POTASH INSTITUTE, INC.
INVESTMENT BUILDING **WASHINGTON, D. C.**

Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

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Editorial Office: Investment Bldg., Washington, D. C.

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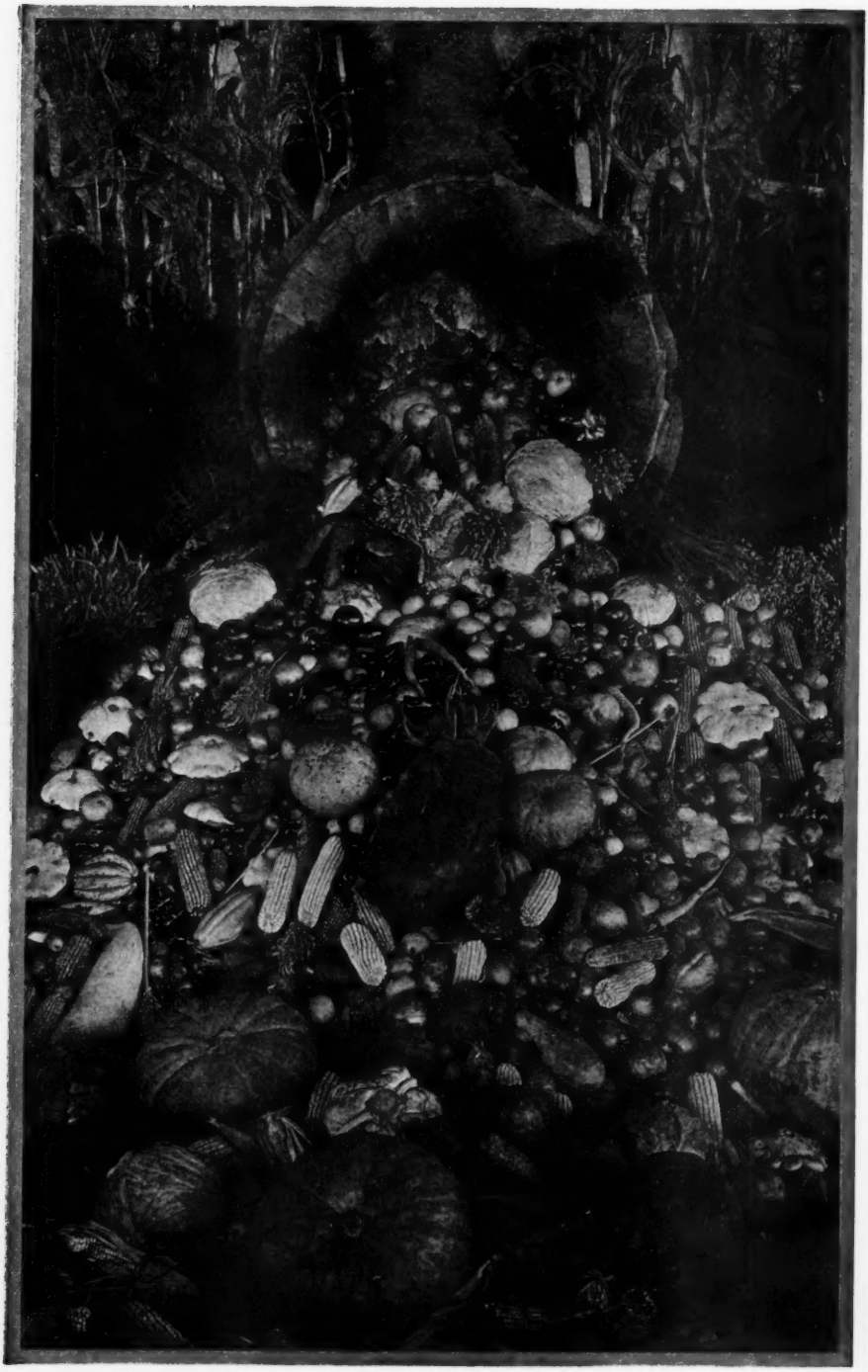

"FOR PEACE, AND PLENTY, AND ALL OUR BLESSINGS. . . ."

Better Crops with PLANT FOOD

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VOL. XXIV WASHINGTON, D. C., NOVEMBER 1940 No. 9

November thoughts dwell upon—

Provisions

Jeff McDermid

IN this age of powdered milk, frozen fruits, dried turkey in tins, and gelatin for protein drinks, the art and craft of whetting human appetites is doing much to offset the surplus of the soil. Flamboyant food advertising makes billboards boost our board bills, while vitamins in victuals give us more than normal zest for culinary occasions.

It is a thrilling race between the ambitious and machine-skilled farmer (and his cousins, the drovers and horticulturists,) against the purveyors of groceries glorified, in their modern, streamlined, rainbow-lighted palaces of provisions. No doubt one reason why we bejewel our food shops and bedazzle magazine readers with catchy table hints is that Americans in majority do not need the tonnages of eatables per capita that our forefathers consumed so avidly; hence the necessity for stimulating the salivary glands with printers' ink and neon lights.

If all our consumers had time or courage to read that hefty volume produced by agriculturists at Washington, called "Food and Life," they would fortify themselves with facts on all the lore of balancing rations, plus the cue on how to avoid the blandishments of faddists and such foolishment. But few will ponder those pages compared to the millions who will grab circulars out of cheese boxes, cranberry barrels, and sauerkraut kegs, to find more ways to serve the family without insulting it.

If farmers could impart their health and dinner-table ability to consumers along with the truck they practically give away, I am sure we would enjoy a right hearty Thanksgiving and nibble quite a hunk out of the surplus without squandering it. Neither would we have to spend so much time monkey-

ing around with white rats before we began stuffing humanity.

It might not be out of place to look back to the early times hereabouts, before they fed stuff to guinea pigs or baled out the farmers with food-stamps. As November is dedicated to the larder, it is not amiss to ponder awhile on the customs of the colonists relative to foods and the ways they used to get trade at butcher shops and groceries. And if anybody starts any war talk or political aftermath, make him dine at the second table.

Early American colonists were well supplied with man-sized appetites, but the shortage came in food itself, and the amount of linage used to tell about it. Beyond doubt, the first meat shop advertising was done by the bell man or town crier. The first graphic advertising of meats in the colonies was that displayed on the gaudy signboards of wayside inns and popular caravansaries. Here Mine Host welcomed his hungry and thirsty guests underneath signboards that pictured the delights of the epicure. Like the colonial fondness for roast beef, this custom was imported from England.

No doubt the memories of the colonists were stirred by recollections of jovial hours spent in such inns as the Ribs of Beef at Norwich, the Cow Roast at Hampstead, the Beef Steak Inn at Bath, or the Boar's Head at Eastcheap, made famous by Jack Falstaff and by Shakespearian dinners held within its walls by Wilberforce and Pitt.

AT any rate, our study shows us that there were many famous American inns that betokened luscious meats in name as well as in nature. The Bull's Head on the Bowery in the late eighteenth century was largely patronized by cattle drovers and butchers who had their stalls on the Fulton Street Market. Daniel Drew, who drove cattle from the Mohawk Valley, tells about this inn and how it was finally superseded in popularity by a second Bull's Head Tavern, located at 26th Street on the old Boston turnpike. This newer place became famous for "city bloods" who resorted there for turkey feasts and turtle dinners.

Still another Bull's Head was located as a pre-revolutionary stage stop at Bound Brook, New Jersey. Ye Olde Chop House, still operating on Cedar Street, New York, was originally founded on Duane Street. In Baltimore among several ancient inns, there were the Bull's Head on Front Street and the Golden Lamb. Over on quaint Staten Island there was opened another Bull's Head Inn, about 1741, with the sign still visible in 1926. This inn had a strange history and was at one time the hang-out of the Hatfield boys, a gang of ruffians.

JUST a few other taverns boasted meaty signs and served choice cuts to all comers were the Lamb Inn at Lancaster, Pennsylvania; Sheep's Ear at Mt. Augusta, same State; and the Durham Ox, the Sheep and Drove Yard, and Peg Mullen's Beef Steak Inn, all of Philadelphia. It was at such gathering places of roistering wits and gormandizers that the first published appeals to culinary quality were announced and publicized.

Broadsides and handbills were also the means used to acquaint the public with good food and prices thereof. As found in lists of titles on file in the Boston Public Library, these related to establishment of open markets and quoted prices for beef on the hoof. But a seeker after original advertisements must go through many yellow files treasured on the shelves of the best historical libraries. To whet my appetite for Thanksgiving, I fell to among such ancient documents and give you the results of my zealous labor.

It was my desire to find the first bona fide food advertiser. It is printed in the first volume of the Boston *News Letter*, established as the first permanent American newspaper by John Campbell, postmaster, issued as a half-sheet folio, beginning April 17, 1704. Not only was this enterprising fellow the first provision advertiser, but he

became the first merchant of any kind to patronize the press. Thus I am able to contradict a noted advertising authority, Frank Presbrey, who claims that a ship-chandler of Boston, one John Mico, did the first advertising. Yet here we see in one corner of the *News Letter* for December 7, 1705, the following imprint:

"James Leblond, located on Long Wharf, sugar, salt, rum, spice, cocoa and chocolate."

If Leblond was a trifle late for Thanksgiving with his copy for Postmaster Campbell, he spread it before the "publik" just in time to catch the Christmas goody trade anyhow—and no doubt Jim Leblond lived to praise the day he broke into print to fetch the housewives scurrying down the cobblestones to buy his viands.

He was smart, too, for most of the colonial papers did not carry any provision advertising, being cluttered up at all times with notices of imported dress goods, strong and varied liquors, runaway slaves, and quack nostrums. Once in awhile one sees tucked away in odd corners of the early sheets, such phrases as

"Besides claret and frontignac wine, a variety of other goods too tedious to mention, along with a fresh supply of Doctor Siebie's pills."

New York Gazette and Mercury, Hanover Square, on September 27, 1779, carried a small card for one Michael Kearney, located on Smith Street, who sold "mess pork in barrels, ox tongue in half ditto, Rose butter in firkins, also excellent bottled claret." Evidently the war for independence did not wipe out the desire for victuals and drink.

In the *Massachusetts Sentinel* of December 1785, toward the end of the war, a significant ad was inserted by Hewe's Boston Butchery, with a salting house adjoining. It was "near the Liberty Pole." Also located "opposite the Liberty Pole," an advertising in the same column, was a certain Paul Revere. He had a general assortment of hardware, pewter, brass, copper, and plated ware, tea trays, brass candlesticks, and carving knives. It is not improbable that both Master Revere and Butcher Hewe were cronies and fellow members of that reckless gang of patriots who were always up to any brave mischief that the times and the temper of the populace demanded. Hewe furnished the food and Revere supplied the tableware for many a convivial banquet in the brave days of old.

RETURNING to the *New York Gazette* files, there is a modest advertisement inserted in late 1799, the year of Washington's demise, which states that "John Pell on Queen Street, sells May butter, pork and beef, playing cards, pipes and Holland gin." This same Pell lived to have a street in the Bowery named in his honor.

In the early files of Baltimore papers for 1805 we hoped to locate references to that overland feat by George Renick of Ohio, who had driven several hundred head of western cattle to the Maryland markets—but the newshawks were not alive to it.

Yet the dawn of the 1800's brought the lively voyages of the famous Yankee clipper ships to the fore. With spanking sails and gusty crews of sea-dogs, those

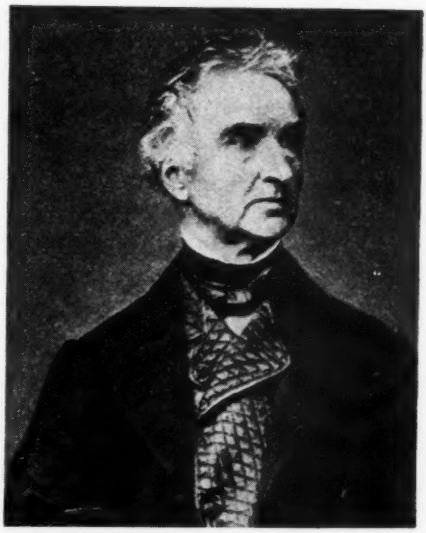
(*Turn to page* 46)

Research in Potash Since Liebig

By Dr. J. W. Turrentine

President, American Potash Institute, Inc., Washington, D. C.

ON September 9, 1940, three divisions of the American Chemical Society—Division of Agricultural and Food Chemistry, Fertilizer Chemistry, and History of Chemistry—combined to hold a symposium on Justus von Liebig who in 1840, 100 years ago, on invitation by the British Association for the Advancement of Science, submitted a report to that organization on organic chemistry, etc. This report dealt principally with agricultural chemistry, summarizing the state of knowledge of that day, and so rigorously attacked the then common idea that plants fed on the organic parts of dead plants (humus) that a prolonged controversy was started, in which Liebig triumphed and since has been credited with having established the fact that only mineral (inorganic) food materials are taken up by the plant through its roots.



Justus von Liebig. From an original photograph taken during his stay in Munich, 1852-1873.

Liebig has been canonized as the patron saint of the potash industry. However, much of what he wrote discussed the work of others; and the opinion is expressed that his service to argicultural chemistry was not so much the contributions from his own laboratories as the publicity he gave to those from others. In his report of 1840 he summarizes and weaves into an elaborate composition the observations of both predecessors and contemporaries, giving his own interpretations, some remarkably wise, others subsequently proving untenable.

There is little point in memorializing his misconceptions. It is well worthwhile, however, to note some of his conclusions on the role of potash in the mineral nutrition of crops, for these conclusions have withstood 100 years of research with practically universal acceptance today.

Throughout his discussion he stressed the great importance of potash and other bases, such as calcium and magnesium, in the nutrition of the plant, partly to counteract the humus theory of plant nutrition prevailing at that time. From a consideration of analytical data available to him, coupled with considerable deductive philosophizing, he concluded that plants vary in their inorganic content with the composition of the soil on which grown and at different stages of growth, and that they

sometimes contain less potash at maturity than during the growing season. Correlating the kind of plants growing on a soil with the composition of the soil, he concluded that there were numerous plants which could grow only on soils containing potash, and that this nutrient was "perfectly indispensable" to their growth; that plants with a high potash content were not found growing on sandy soils, because such soils were low or lacking in potash.

Liebig advanced the idea that the total of bases in plants growing under different conditions was fairly constant, a concept that in recent years has been receiving renewed attention. He arrived at this conclusion from a careful analysis of the data obtained by others who entirely overlooked this significance. These data showed that the same species of plant growing under different soil conditions contained varying amounts of potash, calcium, and magnesium, and because of this variability, had been interpreted as meaning that these bases had no particular influence on growth. Liebig recalculated the data to the oxide equivalents and found that the total of oxygen thus calculated was approximately the same for all plants. Thus, he pointed out that larger amounts of lime were accompanied by smaller amounts of magnesia, and conversely, the foundation for the present-day concept of the antagonism of ions in plant nutrition.

Replacing Lost Fertility

Liebig laid great stress on the possibility of exhausting soils by continuous cropping, if the bases removed were not replaced by manure or artificial fertilizer, citing the depletion of both European and American soils by the one-crop system 100 years ago. He recognized the recuperative powers of soils and stated that one of the great benefits from fallowing was the weathering of minerals in the soils with the release of plant nutrients. He stated: "The potash contained in the soil itself is inexhaustible in comparison with the quantity removed by plants. But when we increase the crop of grass in a meadow by means of gypsum, we remove a greater quantity of potash with the hay than can under the same circumstances be restored. Hence it happens that, after the lapse of several years, the crops of grass on the meadows manured with gypsum diminish, owing to the deficiency of potash. But if the meadow be strewed from time to time with wood ashes, even with the lixiviated ashes which have been used by soap boilers, then the grass thrives as luxuriantly as before. The ashes are only a means of restoring the potash."

Internationally Discussed

Liebig showed the applicability of his ideas to practical agriculture and taught that the treatment of a soil should be adapted to its needs and to those of the crop growing on it. He stated: "A fertile soil ought to afford to a plant all the inorganic bodies indispensable for its existence in sufficient quantity and in such condition as allows their absorption. . . . The fertility of a soil is much influenced by its physical properties, such as its porosity, color, attraction for moisture, or state of disintegration. But independently of these conditions, the fertility depends upon the chemical constituents of which the soil is composed . . ."

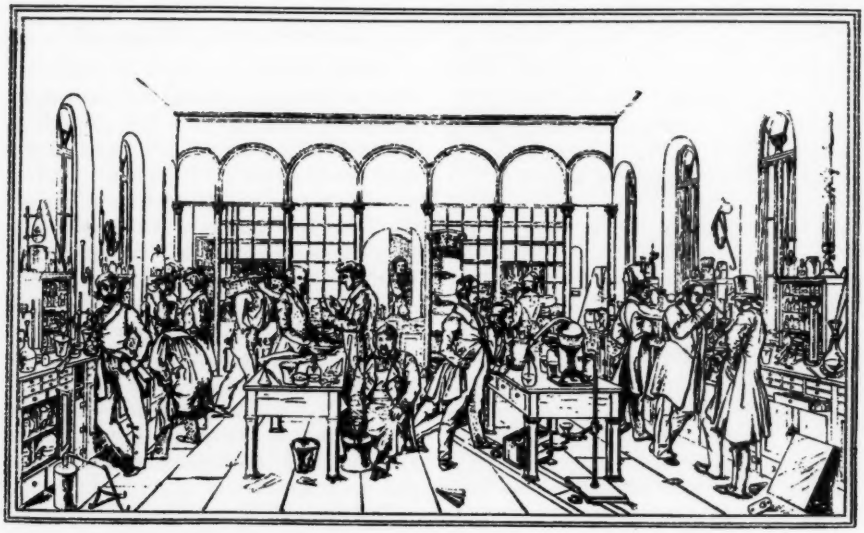
Liebig's treatise launched him into an international scientific discussion which continued up to the time of his death in 1873, stimulating the participants to experimentation to substantiate their respective contentions. This resulted in much research in agricultural chemistry, which has continued in ever-increasing volume to the present time. It is interesting to note even in bare outline the great advances made in this science since Liebig's simple but revolutionary statement of 100 years ago.

Liebig, recognizing potash minerals in the soil as having been the source of that plant food relied upon up to this time, recommended the addition of potash compounds in slightly soluble form, fearing losses from leaching, otherwise.

That error was soon proved. The

soil chemist did not stop with that proof but up to the present day has continued his researches to determine exactly why soluble potash salts do not leach. The physico-chemical reactions between these salts and the widely varying and complex inorganic and organic compounds of the many soil types explain why in most instances potash in the soil leachate is low yet is still present in the soil in a form available for plant use; why a compound freely soluble in water disappears so largely from the soil solution yet is still present in that soeral colloids functioning in this respect, the incorporation of organic matter in the lighter and sandier soils takes on additional significance as a means of reducing potash losses by leaching.

Superimposed on and closely integrated with simple adsorption is the major base exchange reaction, whereby the potassium ion enters into a loose type of chemical combination with soil materials from which it can be displaced readily by the hydrogen ion of carbonic acid, entering the soil solution as potassium carbonate, in which



View of the Analytical Laboratory at Giessen, from a drawing made in 1842.

lution in amounts sufficient to feed the plant.

The soil chemist reveals to us that the retention of potash by the soil is the result of any one of three mechanisms operating singly or simultaneously. The simplest is straight adsorption of the potassium ion, that ion having a high coefficient of adsorption. Adsorption being a surface phenomenon, the degree to which this mechanism operates is influenced by the surface exposed and is therefore more marked in soils of a high colloidal content on the one extreme than in the coarser sandy soils on the other. Both organic and minform it is taken up by the plant. This release is induced by the carbon dioxide released as plant root secretion and through the decay of organic material in the soil; and it is this release which we simulate with the extracting solution used in determining the replaceable potassium of soils. In both forms of retention the potash is still available. In certain soils characterized by their content of certain mineral colloids, the third type of reaction occurs whereby the potassium ion enters the crystal lattice of these minerals and becomes fixed in a non-available form. This reaction, fortunately infrequently encountered, is

accelerated by alternate wetting and drying and is retarded by surface mulching and band-placement and deep incorporation of potash salts.

By such natural agencies, leaching is retarded and in many soils reduced to a minimum. Further measures, however, are justified and on sandy soils imperative. The incorporation of organic matter is effective, but of particular importance is the growing of cover crops. Deep-rooted crops such as the legumes absorb large quantities of potash from the soil solution, with a direct influence on the amount that otherwise might be leached. Winter cover crops, especially in the South where the soils do not remain frozen, have particular significance in reducing leaching while at the same time controlling surface erosion during the winter months of heavy rainfall.

This picture shows the condition of the same Analytical Laboratory in 1845.

Liebig's name is linked with quantitative analysis, pioneering in that field of agricultural chemistry. From that beginning we have passed through several phases, some based on conclusions as erroneous as some of Liebig's.

Soil analysis was developed to a high state of accuracy, the mineralogical chemist contributing to technique. These methods gave us exact data as to the total potash content, and our literature is replete with such analyses of the major soil types from all sections of the country. Where we made our mistake was in assuming that these potash data had a bearing on soil fertility. It being accepted as obvious that the potash of minerals was the source of the potash used by plants and through mineral disintegration by natural agencies had been ample through countless years for the forests and grasses that covered the surface of primeval America, it was assumed that it would be ample for almost continuous crop production.

This concept persisted for years in the face of innumerable data showing crop response to potash applications. Realizing the fallacy of such criteria, soil analysis by the chemist yielded to field tests by the agronomist. Then, returning to the laboratory, the two, the chemist and the agronomist, collaborated in developing the Neubauer test, reducing to 17 days the time required to obtain a measure of plant response to soil nutrients. The chemist, however, persisted in his contention that the plant's ability to extract nutrients from the soil

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These Irish potatoes on the Wilkinson farm have been fertilized with a ton of 5-7-7 per acre and dusted with calcium arsenate to control the potato beetle. The Irish Cobbler variety is grown almost exclusively on this farm which is located in fine potato country.

A Few More Good Men

By F. H. Jeter

Editor, Agricultural Extension Service, Raleigh, North Carolina

IT TOOK faith to see fertile farm land in the tangled mass of stumps, tree-tops, climbing vines, and general debris which remained after woodmen had cut the cream of the timber from the swamps which lie just back of North Carolina's coastal sounds. It took deep-seated courage to follow this faith with dollars in attempting to clean up the slash and to drain the land that crops might draw upon its fertility for the benefit of mankind. Some of those who went into that section had sufficient faith but insufficient dollars and were not able to stay—but a few remained. A few of the few who remained are there today, and they say that the land is good if it but had good men to handle it.

One of these few is S. W. Wilkinson of Pantego, a 78-year-old stalwart who has been farming in the famous Terra Ceia section for 53 years, and who has made much money and lost a lot. Today he operates a 2,200-acre farm of which 1,200 acres are in cultivation, and where corn will still average 40 bushels to the acre without commercial fertilizer.

"I was born in this section 78 years ago," Mr. Wilkinson told me on a recent visit. "My father had a small 50-acre farm on some of the older cleared land, but he died young and we lost the farm because of a small mortgage of $1,000 on the property. I moved back here in 1895, and since that time I have stood back of all the development in this section."

Mr. Wilkinson and his brother John contracted to buy 20,000 acres of the swamp land from a large lumber concern, with the company retaining the lumber rights. To make money to de-

velop the property, the Wilkinsons got the contract to "log" the land. There were no roads into that section at that time, so the Wilkinsons had to build a log road, and finally they persuaded the Norfolk-Southern Railroad to build into Bishops Cross Roads, a small village nearby. Next, the Standard Oil Company was induced to come into Belhaven and establish the large cooperage company that has just folded up due to a lack of and the need for timber for barrels.

The Wilkinsons made lots of money from that original 20,000 acres of land. The lumbering process paid them well and then they began to drain the land and to sell it to prospective settlers. A number of farms were sold, but men inexperienced in growing crops under such conditions were sent down to manage the holdings and pretty soon much of the land was turned back to the original holders. This meant that the Wilkinsons had a hard time. John gave up and moved away but Sam remained to shoulder all the debts and finally to work his way clear with the large farm and beautiful country home that he owns today.

It was in early spring at the time of my recent visit, and as we drove along the road built on a canal bank and came onto the Wilkinson holdings, we saw tractors at work in corn fields cultivating two rows at a time. The rows stretched back into the distance nearly a mile, and the land was as level as a floor. The green corn sprouts appeared above the dark soil in periodic spacings like emeralds in a setting of ebony. The laborer said he could cultivate 60 acres in a 12-hour day, and that the corn produced about 50 bushels to the acre. Mr. Wilkinson keeps 4 of these tractors busy throughout the season, and there are 10 mules to do the small work.

Corn, Potatoes, Onions

Corn is the main crop on the Wilkinson farm, and 400 acres are given over to its cultivation each season. In addition, 350 acres are planted to early Irish potatoes, with the average yield amounting to about 125 bags of 100 pounds each per acre.

Mr. Wilkinson uses little fertilizer under his corn, but makes an application of about 2,000 pounds an acre for his Irish potatoes. This usually analyzes about 5 per cent nitrogen, 7 per cent phosphoric acid, and 7 per cent

"I have a hard time buying buggies now," said Mr. Wilkinson, "This one came from Chicago." One of the laborers attends to the job of hitching the mule to the buggy and driving it to the yard of the Wilkinson home each morning and noon.

potash. Sometimes he increases the potash content to 8 per cent.

During the last 2 or 3 years, Mr. Wilkinson has experimented in growing a small white onion which he brines and sells to a pickling concern. "I have 75 acres in the onions this season," he said, "but last year, I grew 180 acres. They are right expensive to grow but have paid me a good profit. We fertilize the onions with a ton of a 5-7-7 fertilizer per acre, and then we follow corn after the onions and potatoes."

Practices Soil Improvement

In addition to these three crops, Mr. Wilkinson grows some 800 acres of soybeans for soil improvement and for the sale of the grain. Soybean harvesters are used to gather the beans, and the average yield is about 20 bushels per acre, though in good seasons this yield has jumped to 40 bushels an acre.

This Terra Ceia section is a land of canals and ditches. The roads lie along the canal banks, and Mr. Wilkinson says he has at least 100 miles of open ditches on his own place. The land lies only about 15 feet above the sea-level, and complete drainage is necessary. The small grains—oats, wheat, and rye—are grown in winter, and much lime has been found necessary for best crop returns. Mr. Wilkinson uses from 1 to 2 tons of lime per acre, gradually getting over all of his land.

"I have to watch that lime proposition, however, because too much will cause the potatoes to scab," he observed. "But, if I do not use it, I cannot make very good crop yields."

Corn is a cash crop on the farm, contrary to the usual condition in the South. "I sell shelled corn and get about 65 cents a bushel for it," he said. "I have about 5,000 bushels in my crib right now."

Mr. Wilkinson says his section of the Terra Ceia country is the best territory for growing Irish potatoes to be found between Florida and Maine. There are between 2,000 and 3,000 acres of land right in the territory about his farm that produce excellent yields of high quality spuds. Buyers come to the farm to get the Wilkinson crop and are eager bidders. If the vigorous growth which I saw at the time of my visit is any indication, Mr. Wilkinson's claims must be correct.

Years ago, agronomists of the North Carolina Experiment Station were invited to the Wilkinson farm to study

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Four of these tractors work 12 hours a day cultivating about 60 acres of corn each. The fields are divided by ditches, and acre yields of from 40 to 50 bu. of corn are the average.

Taking the Road Back To Soil Fertility

By Kenneth S. Davis

U. S. Department of Agriculture, Soil Conservation Service, Milwaukee, Wisconsin

THIS is the story of the Big Creek watershed—155,000 acres of land in northern Missouri and southern Iowa, typical of some 11,000,000 acres that make up one of the Midwest's major "erosion problem areas." This is the story of the land, of the people who live on it, of what they did to it, and of what they are now doing to restore it.

We can begin with the Teale farm, 240 acres of rolling land 5 miles northwest of Lamoni, Iowa. The farm was first purchased from the Government in 1853, soon after the first white settlers came into the Big Creek area. The Teale family bought it in 1880 and moved on it the following year.

It was a good farm, rich in black, crop-growing topsoil. It yielded abundant harvests which spelled prosperity for the new owners. Additions to the small house which originally stood on the farm resulted, finally, in one of the finest farmsteads in the community. And when the family sold the farm in 1900 at a very handsome profit, it was apparently as good as ever. There were no gullies on it. In fact there were few gullies in the entire community, according to H. B. Teale, whose father bought the place in 1880.

When H. B. Teale, who is now a businessman in Lamoni, visited his old home in 1934, he could hardly recognize the place. Gullies gashed the formerly smooth, rolling fields. Sheet washing had stripped most or all of the topsoil from many slopes. The farm would no longer support a farm family at a decent standard of living without the expenditure of more money for "land treatments" than most farmers could afford. And this damage had been done in 30 years!

That was the fact which impressed Teale. In a generation or less a good farm had been lost to erosion, had bled its substance down the creeks and rivers with every heavy rain, until it had become a caricature of its former being—emaciated, scarred, sterile. "Looks like a battlefield," thought Teale, and when he checked back over the recent history of the farm, he found that it had indeed been through a war.

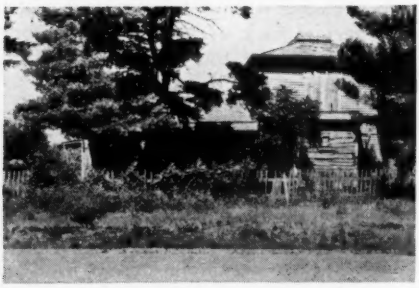
"Force Farming" Destructive

The man who bought the farm from the Teales in 1900 sold it in 1917. That was the year that a new farming slogan swept the land: "Food Will Win the War." The new owner, from motives of both patriotism and profit, started "force farming." He plowed up every available acre, planted it to cash crops (corn and small grain), and kept on planting those crops year after year in an effort to beat the economic depression which set in as soon as the artificial war market collapsed. Crops used up the life-giving humus in the soil, and little or no effort was made to balance fertility outgo with fertilizer applications or legume hay crops. More im portant, the soil became steadily less receptive to rain, more and more water ran off carrying soil with it, and growing gullies cut bare fields into narrow ribbons of infertile soil.

In 1932, the Federal Land Bank was forced to foreclose on the mortgage it

held on the place, and the farm was abandoned to make a tragic ending to the story of land misuse. The bank has now repaired the old house, repainted it, made it respectable again, but rebuilding land is a slower and more difficult process. It takes Mother Nature from 400 to several thousand years to build a single inch of topsoil under blankets of grass or trees. Erosion processes, at work on open, unprotected slopes, can remove that much soil during a single heavy rain.

Above is the farmstead H. B. Teale remembered, his boyhood home near Lamoni, Iowa. At that time, the farm was rich in fertile topsoil and the Teales were a prosperous farm family.



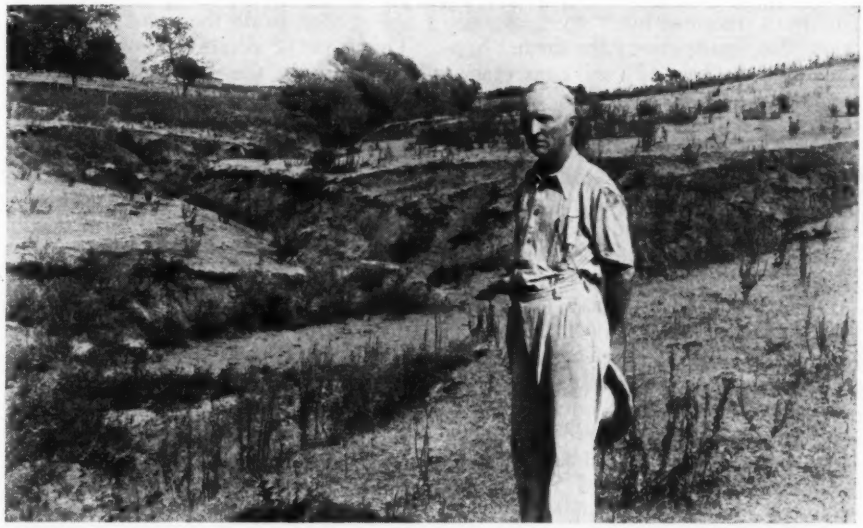
The Teale family sold the farm and a system of cash-crop "force farming" was established by the new owner, with the result shown above—an abandoned farm, gashed with gullies, stripped of topsoil.

The Federal Land Bank at Omaha, Nebraska, foreclosed on its mortgage on the farm in 1932, thus completing the cycle from government land grant to government foreclosure. The bank has remodeled the house, made it respectable again.

Unfortunately, the Teale farm is no isolated example of land decline. There are other examples—too many others. For 80 years, the dominant soil trend in the Big Creek area, as in most other areas in the Midwest, was from rich to poor. The first settlers found the area covered with prairie grasses, a rolling sea of grass broken here and there by patches of timber thrust up along streams and in rough areas. They found a layer of topsoil, 12 to 16 inches thick, rich with the fertility accumulated during thousands of years of plant life and decay. When they sliced through the prairie with their "sod-busting" plows and planted crops, they reaped harvests of corn averaging 50 bushels per acre and sometimes going to 100 bushels, harvests of oats and rye varying from 25 to 40 bushels, despite their use of seed strains which, by modern standards, were definitely inferior.

But for the most part, the early settlers engaged in livestock farming. Grain farming gradually increased in importance as the prosperous years passed, but not until the World War did it assume major importance.

The World War marked a turning point. Indirectly, through its stimulation of the market, the war speeded up and brought out into the open a destructive process which had been at work on most of the cultivated fields since the prairies were first plowed. The shift from livestock to grain farming was abrupt. Thousands of acres of land, formerly protected by grass and used as pasture, were plowed up and planted to cash crops—corn, wheat, oats. A convenient marriage of profit and patriotism gave issue to an orgy of soil exploitation for which Big Creek farmers have been paying ever since. Soil erosion, formerly a sneak thief stealing soil slyly, became a bold thief, stripping off layers of surface soil



Rebuilding soil is a much slower and more difficult process than rebuilding houses. H. B. Teale stands on the bank of a gully which has ruined acres of formerly good farmland. He was shocked at the sight presented by his old home farm when he visited it 30 years after leaving.

and gouging out gullies with no effort at secrecy.

This process continued long after the war was ended. During the boom years, many farmers mortgaged their farms to buy more land, more equipment, new buildings. When the war market collapsed in the early 20's, these farmers were forced by the debt load they carried to continue turning soil fertility into cash, with little regard for the needs of the land itself. Gullies grew and crop yields declined.

Topsoil Washed Away

By 1934, when a detailed soils survey was made in the Big Creek area, the depth of topsoil had declined from an original average of more than 12 inches to an average of from 4 to 6 inches. From one-fourth of the watershed area, or more than 35,000 acres, 75 per cent or more of the original topsoil had been washed away; hundreds of acres of subsoil were exposed.

Thus spots of barren earth had developed and were slowly spreading, like the blight of a disease, over the landscape. At the violent hands of man, thousands of acres had sickened and died. Mother Nature was carrying out a "scorched earth" campaign of her own.

But 1934 marked another turning point. In the fall of 1933, the Federal Government cooperated with the University of Missouri in the establishment of a soil conservation "demonstration" project in the Big Creek watershed, with headquarters at Bethany, Missouri, the second of the 176 projects to be established in the United States and Puerto Rico. A staff of trained soils technicians, engineers, agronomists, foresters, and farm-management specialists moved in to help farmers battle the erosion menace. By the spring of 1934, the project was well under way.

Purpose of the work was to show farmers how to conserve soil by actually having representative farmers do it on representative farms. Thus the project was designed to serve, not merely the farmers in the Big Creek area, but also all other farmers facing similar erosion problems.

To that end, every farmer in the 155,000-acre area was given an opportunity to enter into a "cooperative agreement" with the U. S. Soil Conservation Service (then known as the Soil Erosion Service), whereby the farmer agreed to

follow a recommended soil conservation plan, made out by the farmer himself with the help of a soil conservation technician, for a minimum period of 5 years. The Service agreed to provide the farmer with technical and a certain amount of material assistance in carrying out the planned program. Of the 1,042 farmers in the area, 818—operating 117,000 acres—became "cooperators."

In framing the farm plan, technicians and farmers made use of data obtained through the soils survey which has already been mentioned. Soils men went over each farm, equipped with soil augers, air maps, surveyors' instruments, and mapping tables. On the air maps were recorded data as to soil type, degree of erosion, steepness of slope, and present land use; data which, when combined with information concerning the individual farmer's financial condition and farming preferences, provided a firm factual basis for erosion-control planning.

As for the plan itself, it called for a "complete" or "coordinated" program, covering every acre of each farm and making use of whatever soil-saving practices or combinations of practices are needed to do the conservation job. This type of demonstration is a new departure in the field of agricultural "education by example." State and Federal farm agencies have long made use of the demonstration teaching method, but heretofore demonstrations have generally been of single practices—pasture renovation on one farm, fertilizer applications on another, terraces on another, and so on. In Soil Conservation Service demonstrations, the different practices are tied together in a single program having a single objective: soil use without waste.

A Typical Example

The 160-acre Oscar Anderson farm, a few miles southwest of Lamoni, Iowa, provides a typical example of the way in which the program is applied. The Anderson farm is, for the most part, "on the slant." Soils men in their own peculiar lingo classify the topography as "rolling to broken." There's scarcely a flat acre on the place, and the average slope of the fields is between 6 and 10 per cent (that is, the average field has a fall of from 6 to 10 feet for each 100 feet on the horizontal). Principal soil type

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Erosion follows up and down hill cultivation, especially when clean-tilled crops like corn are grown year after year, as they have been on these fields in the Big Creek watershed.

Raw Materials For the Apple Crop

By J. K. Shaw

Pomologist, Massachusetts State College, Amherst, Massachusetts

I SOMETIMES think of the apple tree as a factory, as a textile mill in which the leaves are the spindles, forming starches and sugars; the looms are those parts that convert these intermediate products into the finished products, new wood and the crop. Sunlight is the power, and the raw materials are the carbon dioxide of the air and water and mineral matter from the soil. Neither a textile factory nor an apple tree can function efficiently without proper machinery, adequate raw materials, and sufficient power. There is one important difference between a factory and an apple tree. In a factory the machinery is built in other factories, while the apple tree builds its own machinery. Any deficiency in raw materials or power not only cuts down the product, but it also causes disarrangement or a breakdown of the machinery.

The supply of power for our apple factory is generally adequate. Even on dull days there is sunlight enough, except when clouds are very heavy. The supply of carbon dioxide is generally sufficient, though when artificially increased, the output of starch may be increased. The supply of water as raw material is always adequate, for any deficiency disarranges the machinery through causing the breathing pores to close, thus preventing the intake of carbon dioxide. It is not practical to try to influence the supply of these necessities except that of water. Artificial supply of mineral matter is of great practical importance to the apple grower, and it may be controlled not only through the application of fertilizer, but also through providing conditions that favor the intake of these essential nutrients. Mineral nutrients are of no use to the plant until they are taken into its living cells.

It was formerly thought that of the mineral elements that are essential for the tree, sulfur, calcium, magnesium, and iron were almost always present in adequate amounts in almost all soils. Sulfur compounds are applied to our orchards in certain of the spray materials used to control insects and diseases, and it seems reasonable to believe that trees will never suffer from a lack of sulfur. Calcium deficiencies have been detected, resulting in poor growth and leaf burn. Shallow soils or coarse sandy soils are most likely to show calcium shortage.

The Need for Minor Elements

Lime is the common remedy for acidity, and it appears that orchards where large amounts of sulfur are used in the form of dusts may develop too high soil acidity for the welfare of the trees. If the pH of the soil drops much below 5, it is likely that an application of lime will be beneficial. Fruit plants may suffer from a chlorosis from lack of magnesium or iron, but such deficiencies are not common.

The importance of certain minor or trace elements in plant nutrition has been developed, especially in the last few years. A relation between the so-called internal cork of apples and boron deficiency has been demonstrated. Dry weather is also a factor. Cortland and

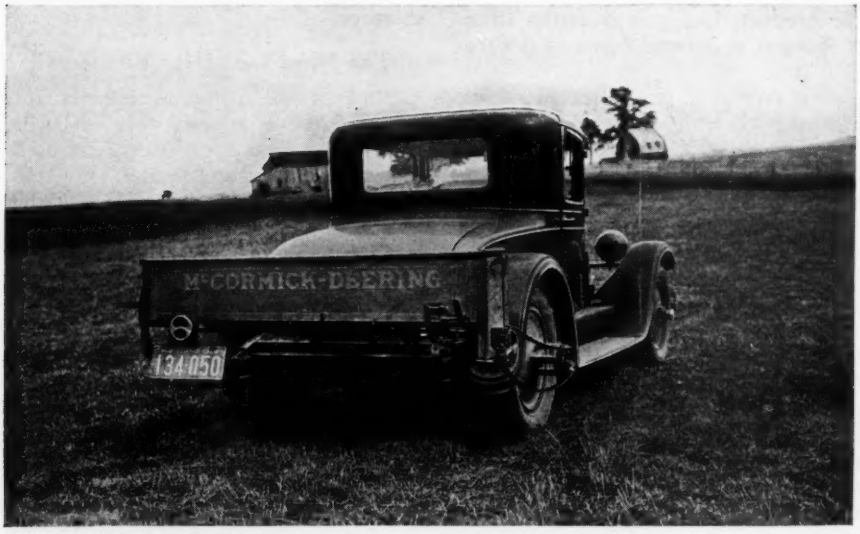
McIntosh seem particularly susceptible to the trouble, but it is not confined to these varieties. Applications of borax to orchards where this trouble has occurred would seem to be good insurance, even when it occurs only in occasional years. It should be remembered that borax is toxic, and care should be exercised not to apply too much. An application of 100 pounds of borax per acre had no toxic effect on apple trees, but this was probably twice as much as necessary. There is evidence that an application once in 3 or 4 years may be enough. Annual applications might prove dangerous.

Territorial Differences

Zinc has proved a remedy for certain disease conditions of fruit plants in the far West and South, but the writer has no knowledge of beneficial effects in the fruit regions of the Northeast. Manganese and copper compounds have been found to be essential or beneficial to plant growth, but again we do not know that either is necessary for the apple crop in this part of the country.

The time-honored doctrine that nitrogen, phosphorus, and potash are the nutrients most essential in fertilizers for fruit crops still holds good. The importance of nitrogen in apple orchard fertilization is admitted by all. Amounts, form, and time of application are still topics of debate. While these questions are sometimes important, the essential thing is to see that the trees have enough nitrogen to enable them to make normal, vigorous growth. The rule of one-fourth pound of nitrate of soda or its equivalent for each year of growth is a good general rule, but variations may be called for according to soil, state of fertility, size of crop, and perhaps other varying conditions. As to the form of nitrogen, the basic rule is to choose the one that will furnish a pound of nitrogen for the least money.

Certain other considerations should be kept in mind. Ammonium sulfate will increase and cyanamid will decrease soil acidity. Urea is more slowly available than nitrate of soda. While an apple crop makes a lighter draft on soil nitrogen than some other crops, it seems reasonable to say that a heavy-producing orchard will require more nitrogen than a low-producing orchard unless, as is often the case, the low production is due to a lack of nitrogen. Formerly, it was advised to apply nitrogen at or



An old car plus an old drill make application of fertilizer to orchards rapid, economical, and easy.

just before the start of growth in the spring. Now, fall applications are frequently advised. This seems safer in southern than in northern apple regions, where it may cause winter injury of the trees.

Coming now to the live question of nitrogen only, or a complete fertilizer, we find wide divergence of opinion. For the last 20 years the advocates of nitrogen only have had the floor. Now there is a distinct trend in favor of the addition of phosphorus or potash or both. However, let us be careful not to go to extremes. It is clear that many orchards have grown and produced well with only nitrogen for many years.

We have found that in our own college orchards, after a period of about 10 years of nitrogen alone, the trees fail to do well and that increasing nitrogen makes matters worse. Reduction of nitrogen is better than increasing it, while the addition of potash improves the growth and yield of the trees. We have as yet no evidence that adding phosphorus to nitrogen and potash helps the trees. This may be generally true along the Atlantic Seaboard, while west of the Alleghany Mountains phosphorus may be of more value than potash, especially on the heavier soils.

Using Complete Fertilizers

How general this condition may be in Massachusetts and neighboring States, we do not know. An examination of the potash content of leaves from some 25 Massachusetts orchards showed less than a half dozen that were suspiciously low in potash. The use of a complete fertilizer is increasing among our growers, due in part perhaps to governmental encouragement.

The maintenance of organic matter in orchard soils is important, and to grow a crop to supply this, a complete fertilizer is essential. We have had very good results from mulching apple trees with waste hay brought into the orchard. This practice is increasing among fruit growers, and the limiting factor is the amount of material available. In a mature orchard it is impossible to grow enough grass to supply an effective mulch, although a little is better than nothing. The man who harvests hay in his orchard to feed his cows is a dairyman and not a fruit grower. It may prove profitable to devote a part of our farmland to growing mulching material to carry into the orchard. There are many trees growing on low, shallow, wet soils that might better be cut down and the land devoted to producing mulch for the better parts of the orchard.

Mulching Increased Yield

The most striking results from mulching appeared when mulch of waste hay was applied to an orchard plot that had been under cultivation with no fertilizer of any kind for 20 years. Naturally, the growth and performance of the trees were very poor. The second year of mulching, at the rate of about 2 tons per acre per year, this plot produced the most heavily of any in the orchard, although previously it showed the lowest production. This suggests that it might be well sometimes to cultivate an orchard until the organic matter was somewhat reduced and weeds and grass suppressed before embarking on a mulching program. No signs of a nitrogen depression appeared in this orchard, even though there were clear indications of low nitrogen supply before the hay mulch was applied.

The absence of symptoms of an overvegetative condition of the trees in the presence of remarkably high concentration of soil nitrates under a heavy mulch is remarkable. We have also found liberal amounts of available potash under a heavy hay mulch, even to a depth of 3 to 4 feet. The lower layers of the decaying mulch and the surface of the soil beneath are filled with a mass of fine, fibrous roots, which in the presence of a liberal oxygen supply should function efficiently. Mulching orchards is a truly effective way to soil conservation.

The question of whether to grow mulching materials outside the orchard

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Legumes like red clover, grown in the rotation with grain crops, are readily converted into roasts and steaks.

Food and Feed to Share

By Earl Wooddell Sheets

Washington, D. C.

THERE are two good words which have always been associated with free men—"FOOD" and "FEED." To some these words may have the same meaning, yet to most of us they are quite dissimilar, although from time immemorial they have been correlated with good soils, and as regards man's welfare, might appropriately be called "identical twins."

Man uses directly for food only slightly less than 30 per cent of all harvested crops produced, the other 70 per cent or more being utilized as feed for farm animals and poultry, which in turn supply man with his most essential group of foods—milk, meat, eggs, and other livestock products.

When the first white settlers came to America they found that the Indian had occupied the country for many generations, how many we do not know. While the food habits of the different tribes varied greatly, their main subsistence came from a combination of animal and plant life. The evident fear of starvation from the "one-crop system" led the Indian to adopt and follow diversification as a means of self-preservation. The tribes living in the lower South found that their existence could not be assured from the fruits, nuts, and leaves of plants. Neither did the tribes in the region of the Great Lakes find that they could have security from either hunting or fishing alone. Then, just as now, droughts, excessive rain, or severe winters and pests of all kinds upset their plans and hopes for any one source to give them enough food at all times.

EDITOR'S NOTE: This is the second in the series of articles by Dr. Sheets. The first appeared in our October issue.

Many of the first settlers in America perished because they did not know or failed to heed the possible hazards of Colonial life or the dangers of the one-crop system, even in a land of plenty. They were saved in some instances only through the generosity and help of neighboring Indian tribes whose ancestors many generations ago had learned the fundamental law of nature, "FOOD IS FIRST."

For the next centuries thrift and willingness to work to produce what they needed marked the determination of the pioneer families in America. They built homes, cleared land, put their dependence in good land and a farm program diversified with livestock.

How does the situation in America today compare with that of our forefathers? Of the estimated one-third of our population that is said to be undernourished, many are on farms. Most of these are undoubtedly among the one-third of our farm population which, year after year, has reported keeping neither cows nor hogs. Many do not have work stock or poultry of any kind, or even a garden. Today, there are many thousands in our own land, and millions throughout the world who look for, hope and pray for food.

While substantial progress has been made periodically for more than a half century to put livestock on farms that need them, yet the same old obstacles, whether they be on small farms or larger ones, are still with us. Simple, workable plans are needed for getting started, financing, fencing, inexpensive equipment, and for the production and utilization or proper disposition of the products. There are some who feel that they are not in the livestock business unless they can count their farm animals by the score and their poultry by the hundreds.

The livestock industry of America is founded upon the greatest wealth of feed and forage the world has ever known. As great as these vast resources have seemed to some, as with food, there is scarcely a time when the pasture, roughage, and other feed supplies exceed the existing and potential demands. It has always been a problem of proper distribution, of production by means of a diversified farm program, and a further distribution so that the feeds are available where, when, and for the purposes needed.

A rotation of food and feed crops conserves soil fertility and gives stability to farming.

Collectively, the stockmen and farmers can and ultimately will do much to correct this situation. Individually they can plan and make their own efforts count for most. In this connection there are three groups of farmers who are especially concerned. One is that increasing group which annually does not keep enough livestock to meet the requirements of the family or produce sufficient feed to adequately support the livestock which they attempt to keep.

The second is that group which produces the pasture, grain, and roughages necessary to feed the farm animals and poultry required to furnish the meat, dairy, and poultry products for home use. Many of them plan, just as their ancestors did more than 200 years ago, to supply family needs, with enough for market to obtain their cash requirements. To them keeping livestock to utilize feed and forage resources sufficient to pay taxes, operating expenses, and a cash return for labor and efforts is a matter of immediate concern. They practice a system of diversified farming, knowing that such a system is necessary to distribute labor among the family throughout the year, so as to reduce outside labor to a minimum, without reducing the net income of the farm through lack of labor at any one time.

The other group is composed of farmers and stockmen who make farming with livestock or ranching their principal business, requiring at least 50 per cent or more of their time. By keeping only animals of the highest usefulness,

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TABLE I—MINIMUM ANNUAL FEED BUDGET FOR LIVESTOCK*

It is essential that at least the minimum amount of pasture be provided at all times with each class of livestock.

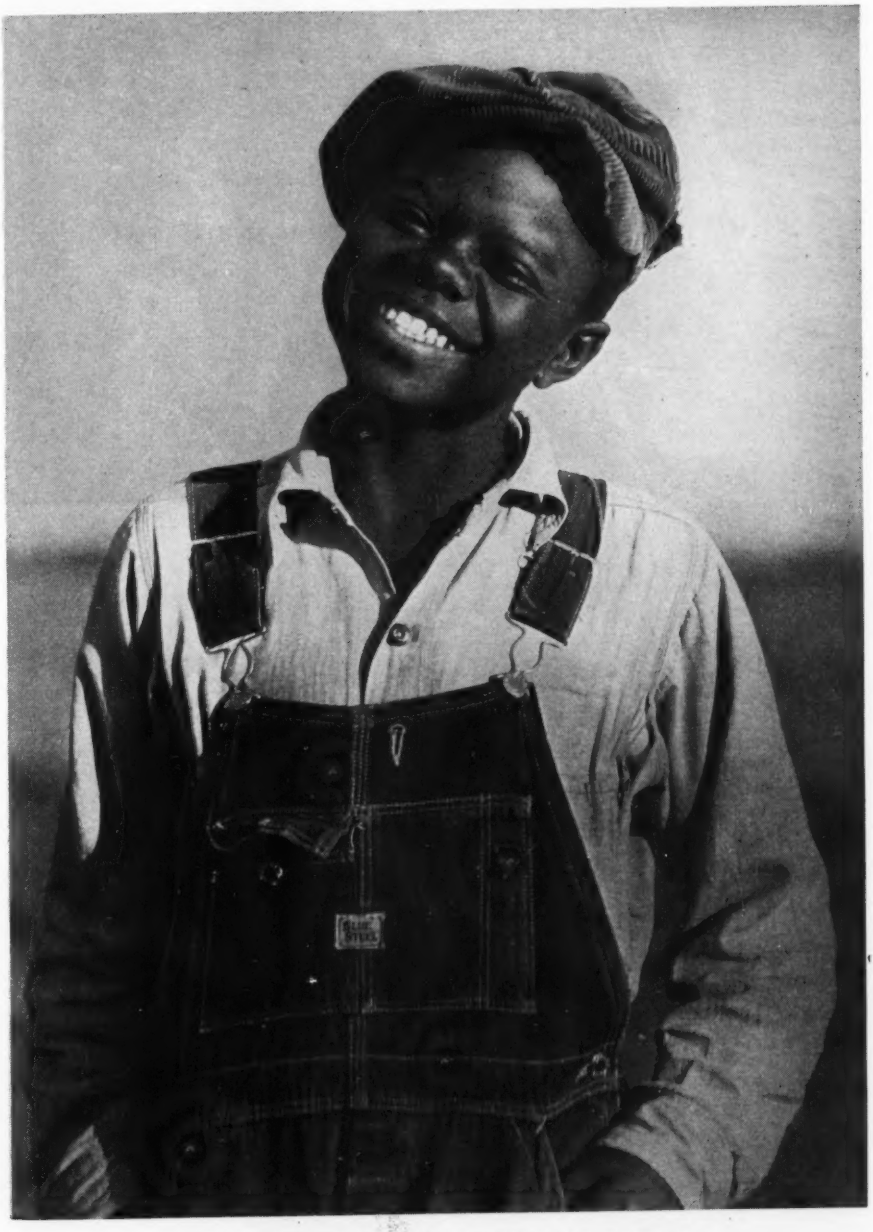
The amount of feed indicated is for one animal in each case unless otherwise stated	Acres of permanent and annual pasture	Roughages†		Concentrates	
		Hay	Silage	Corn or other grain	Protein supplement
		Tons	*Tons*	*Bushels*	*Pounds*
1,000-pound horse or mule, on same basis	1 to 2	2	.....	50	200
1,350-pound mare and foal, to 6 months of age	1 3	2	.....	60	250
Colt, first year	½ 1	½	.....	10	75
Colt, second year	1 2	1	.....	15	100
1 ram and 30 ewes, with lambs	(one per cow unit)‡	1½	.....	25	500
1 sow and 8 pigs	2 4	¼	.....	120	500
1,000-pound beef cow and calf, until weaned	2 4	¼	2	.....	100
1,000-pound milk cow, producing over 6,000 pounds	2 3	1½	5	35	350
Finishing beef calf to 750 pounds	½ 1	¼	¾	40	500
Growing beef, first year from weaning	1 3	¼	¾	.....	150
Growing beef animal, second year	2 4	¼	2	.....	100
Finishing calves on pasture alone, up to 18 months	2 4	.....	.....	.....	.....
Finishing calves on pasture with grain, about 1 year	1 3	.....	.....	20	200
1,000-pound steers for short feeding	.....	¼	2½	.....	750

* From "Feeding Farm Livestock," by Earl Wooddell Sheets.

† It is expected that hogs, sheep, work stock, cattle, and short-fed steers will make full use of stalk fields at harvest time or during the early part of the fattening period.

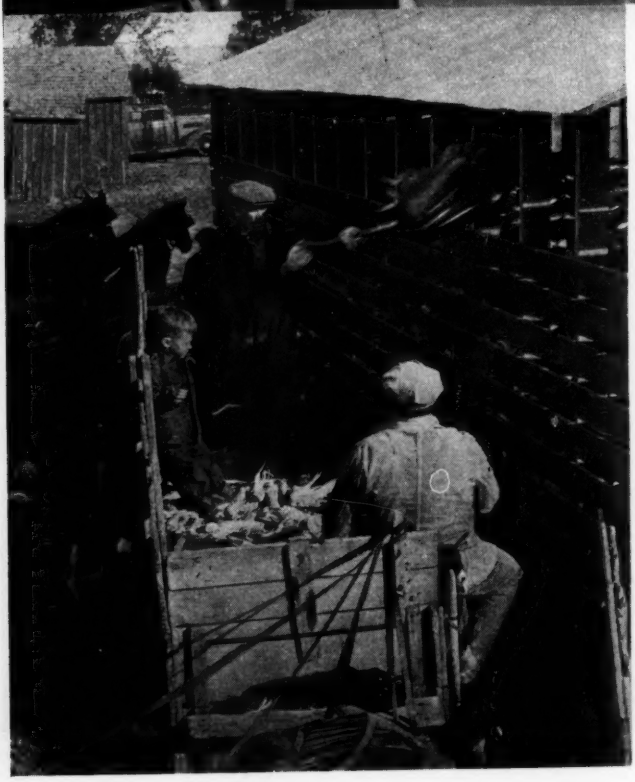
‡ Experience has shown that where sheep are run with cattle or other livestock, uniformly better results are obtained if not more than one sheep is run with each cow unit or equivalent in other animals.

PICTORIAL



"I'SE THANKFUL, CAUSE DE COTTON'S ALL PICKED."

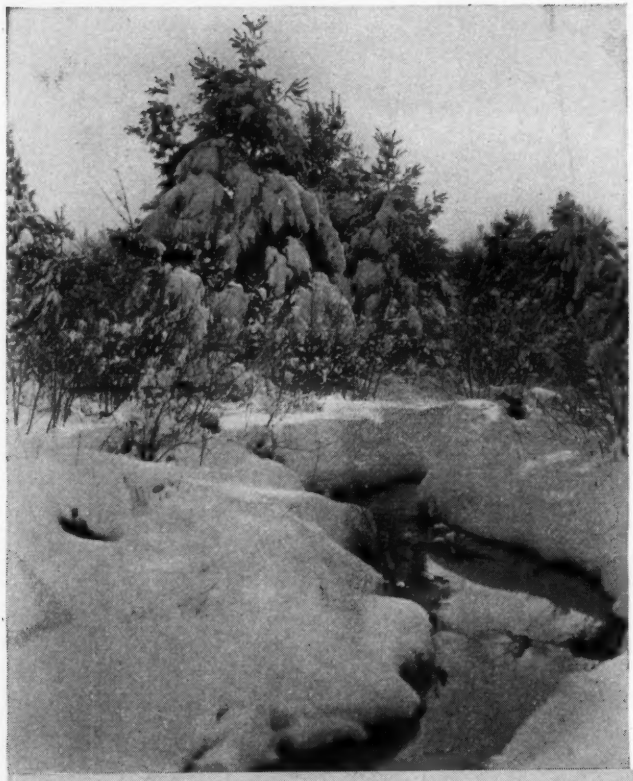
Above: These cronies hold down the sidewalk 'til cold weather drives them to shelter —and checkers.



Left: Satisfaction attends the labor involved in filling the corn bin chock full.

Right: November plowings will be appreciated next spring—particularly if winter proves long and arduous.

Below: Ginned and baled, this cotton is ready for nearby textile mills.



Left: It's a real thrill to wake and find that the first snow of the season arrived during the night.

Below: The crystal landscapes left by ice storms are beautiful but treacherous.

The Editors Talk

A New Farm Map for the South

The farm map of the South is changing. With reduced acreages planted to cash crops, expansion of areas in feed crops making possible the development of a live-stock program, and increased use of soil-building crops, the South is making a definite move toward a balanced system of farm production. Cotton and tobacco remain the chief sources of cash income, of course. But the areas devoted to these crops have been drastically curtailed during the past decade, while the acreages planted to corn, peanuts, small grain, hay crops, and winter legumes have shown a substantial increase.

The greatest reduction in acreage has been made in cotton—in the case of many of the States almost 50 per cent. The most significant development in farm production has been the improved yields of cotton. Records of crops produced in the United States reveal few, if any, parallels to the remarkable and sustained increase that this crop has shown. Several States have raised their averages 30 per cent or more, while all have shown substantial increases.

The reasons assigned for this unusual increase in yield are the reduction in acreage and the selection of the better acres for cotton, intensive cultivation, and heavier applications of fertilizer containing higher ratios of plant food. These practices have been urged by agricultural authorities for many years, and the results obtained are ample evidence of the soundness of the advice.

Second only to cotton from the standpoint of acreage reduction is tobacco. All of the important producing States recorded substantial increases in yields during the past decade, and these increases are being maintained by following the fertilizer practices recommended by the experiment stations.

Corn occupies first position in the South from the standpoint of acreage, and the area devoted to it has shown a large increase during the past 10 years. There has been little change in the yield of corn, some States showing slight increases recently while others have recorded small decreases. Observers attribute the extremely low yields of corn in the South to several causes including low fertilization, the large percentage of the total acreage planted on land of low fertility, and inefficient practices in cultivation.

The advisability of following fertilizer practices on corn which are based upon experimental results obtained in rotations with cotton are being seriously questioned by authorities now. In some sections the use of a complete fertilizer has not prevailed because of the belief that there was sufficient residual phosphorus and potash remaining from the fertilizer application to cotton for the crop of corn which followed. However, with the reduction in cotton acreage and an increase in corn plantings in recent years, it has been impossible to systematically rotate these crops. Consequently, a high percentage of corn is not benefiting from fertilizer in a cotton rotation. The belief that corn should receive a complete fertilizer at planting is therefore becoming very general.

The acreage in peanuts has shown large increases. While the area planted for harvesting is included in the program of agricultural adjustment, there is no limitation on plantings for grazing, and hog producers have used this crop widely in connection with the expanded livestock program. The yield of peanuts, like that of corn, has shown little change in recent years. In many sections there is little or no fertilizer applied, and yields have shown a gradual decline. In other areas the crop is included in the fertilizer program, and yields are being maintained after many years.

Development of the livestock industry in the South is being advocated by agricultural authorities, and the records show that the numbers of hogs and cattle are showing gradual increases. The success of this movement depends upon the extent to which feed crops are produced and pastures are improved and developed. In working toward this end agronomists are urging the more extensive use of fertilizer.

The trend in yields of the cash crops in the South is regarded as very encouraging, but whether there will be any immediate substantial improvement in the production of other crops will doubtless be determined by the extent of the development of the livestock industry. Since successful livestock production depends to a great extent upon economical yields of feed crops, agricultural authorities are urging better fertilization and more intensive cultivation as a means of achieving this objective. Undoubtedly therein lies the hope of substantially increased income in the South.

Think When You Thank

We honor the harvest holiday with some excellent ideas. We mark the occasion in red on the calendar, plan it down to the last cranberry, and then settle back and pleasantly anticipate the fun to be had. Small bickerings may divide us during the year—we seldom see eye to eye on politics, war maneuvers, or what to have for Friday's supper. But come Thanksgiving, we rise above our small and large differences alike, to find that we all have a common share in that old favorite, Thanksgiving Gratitude.

It is interesting to read what Edward Winslow, three times governor of Plymouth Colony, wrote to a friend in 1621. "We set the last Spring some twenty acres of Indian corn and sowed some sixty acres of barley and peas; and according to the manner of the Indians, we manured our ground with herrings or rather shads, which we have in great abundance and take with great ease at our doors. . . . Our barley did prove well; and, God be praised, we had a good increase of Indian corn. . . . Our harvest being gotten in, our Governor sent four men on fowling, that so we might, after a special manner, rejoice together after we had gathered in the fruits of our labor." Those colonists planned, worked, and reaped a harvest which meant the difference between life and death in a grim, new world. Theirs was indeed an occasion for rejoicing.

Looking back over the year this Thanksgiving, let us too enjoy the satisfaction that is the privilege of the day. We have spent a year of living, we have a personal harvest to reap. For peace and plenty and home and friends we can be deeply grateful; but let us not be content to recount our blessings like a miser fingering his gold. Let us look to the future and plan the next harvest with the earnestness with which those Pilgrims planned the first one. It is not enough to wish for ideal conditions, we must learn to transcribe ideals into actualities, justifying the faith that has been placed in every one of us.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ Pertinent suggestions on the use of fertilizers for Georgia peach orchards based on nearly 20 years of peach fertility investigations are outlined in Station Circular 122 by E. F. Savage, entitled, "Cover Crops and Fertilizers for Georgia Peach Orchards." It has been clearly determined that a complete fertilizer analyzing 8-8-6 has given good response in the experiments conducted. A recommended method is to make an application of one-half pound of the 8-8-6 material or its equivalent to one-year peach trees about the first of March, followed by a quarter-pound application of sodium nitrate or its equivalent about June first. These amounts should be increased to one pound and one-half pound rates respectively, for the second growing season. One pound of an 8-8-6 for each year of age beginning with the third growing season to a maximum application of 5 to 6 pounds per year for mature trees should be applied.

In cases where the orchard soil is fairly well supplied with nitrogen through the use of cover crops, a 4-8-6 fertilizer may be substituted, to be applied at the rate of 4 to 6 pounds per mature tree before blossom time in the spring. When the May drop of fruit is over, a side-dressing of sodium nitrate or its equivalent at the rate of one-half to 2 pounds per tree should be given, depending upon the color of foliage and the amount of tree growth indicated.

Since most peach orchards are fertilized with an 8-8-6, the circular states that it is not usually necessary to apply more fertilizer to the cover crop. Liming may be necessary in some orchards, and where superphosphate is advised for the cover crop, it should be applied in the fall just before or at the time of seeding the winter cover crop.

¶ Professors E. H. Rawl and W. C. Nettles, of the South Carolina Agricultural Extension Service, list the 4-8-4, 4-8-6, 5-7-5, 6-8-4, and 6-8-6 analyses as being desirable for the pecan grove in their interesting and informative publication, "Pecan Production," Circular 183. These suggestions are derived from the more complete work on pecan fertilizer investigations of the Federal Pecan Station at Albany, Georgia.

"On poor soils or soils low in nitrogen, the formula containing the highest per cent of nitrogen should be used for trees making poor growth. Soils deficient in potash should receive the formula containing the highest per cent of potash.

"One to two pounds per tree of fertilizer should be used for each year's age of tree." As an example, a tree 10 years old should receive 10 to 20 pounds. The last of February or early March has been found to be the proper time to apply the fertilizer. Some growers have obtained good results by applying half the application in late February and the remainder in June. A good plan is to broadcast the fertilizer from the trunk outward to a distance of about twice the spread of limbs. This is because the root system of pecan trees is very extensive and extends to a wide distance beyond that of the limbs. Where compost or manure is used, it is suggested that this be broadcast under and well

beyond the spread of limbs rather than concentrated near the trunk.

"Fertilizing, Mulching, Correcting Acidity and Other Soils Problems Found in Growing Ornamental Plants," Agr. Ext. Serv., Auburn, Ala., Cir. 175, June 1939, Homer S. Fisher.

"Fertilizer Grades for Connecticut," Agr. Ext. Serv., Storrs, Conn., Bul. 285, Dec. 1939.

"Fertilizer and Lime Recommendations," Agr. Ext. Serv., Newark, Del., Inform. Card 46, Feb. 1940.

"Malnutrition Symptoms of Citrus with Practical Methods of Treatment," St. Dept. of Agr., Tallahassee, Fla., No. 93, Mar. 1940, O. C. Bryan.

"Enfield Soil Experiment Field 1912-1939, General Summary of Results," Agr. Exp. Sta., Urbana, Ill., AG823, May 1940, F. C. Bauer and C. J. Badger.

"Application of Superphosphate," Agr. Ext. Serv., Corvallis, Oreg., Ext. Cir. 348, Mar. 1940, Arthur S. King.

"Fertilizer Law, Chapter 49 of the Code of Virginia, as Amended and Re-enacted by Acts of the General Assembly, 1920, 1926, 1928, 1932, 1936, 1938, 1940," St. Dept. of Agr. and Immigration, Richmond, Va.

Soils

¶ A thoroughgoing discussion of the harmful effects of heavy applications of lime on some Vermont soils is given in Vermont Agricultural Experiment Station Bulletin 460, "The Cause and Nature of Overliming Injury," by A. R. Midgley and D. E. Dunklee. Overliming injury occurs particularly on acid upland podzolized soils, on some sandy soils and acid peat bogs. These soils when brought to or somewhat above neutrality tend to fix much boron in a form unavailable to crop growth. Field results show that the need for borax to benefit certain plants which suffer from excess lime is confined to certain local areas where the soils were once acid, and to a number of apple orchards showing internal cork and other symptoms of boron deficiency.

The corrective value of borax was ascertained for 10 field crops in greenhouse studies using overlimed podzol soil as a medium. Greatly increased yields from application of 50 pounds of borax per acre were obtained by seven crops—rape, flax, vetch, lettuce, tomatoes, beets, and onions. No appreciable benefit was indicated by these investigations for timothy, oats, corn, or other grasses. Alfalfa, sweet, white, red, and Ladino clovers, cabbage, cotton, poppies, mustard, turnips, radishes, spinach, muskmelons, celery, strawberries, and apple trees from transplants are among the other crops tested which received much benefit from borax applications.

Borax may be applied broadcast preferably diluted with lime, fertilizer, sand, or dry soil, or it may be used as a spray. The rate depends upon the presence of active fixing agents in the soil and the extent of liming. Rates from 10 to 40 pounds per acre were found satisfactory for alfalfa. Great care must be given in its use, as even a small excess may prove harmful, the authors advise.

"The Groundwater Supply of the Eloy District in Pinal County, Arizona," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 87, June 1, 1940, G. E. P. Smith.

"A Key to Kentucky Soils," Agr. Exp. Sta., Lexington, Ky., Cir. 51, April 1940, P. E. Karraker and W. S. Ligon.

"Alkali Soils," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 146, J. W. Fitts and H. F. Rhoades.

"Peat and Its Uses," Agr. Exp. Sta., New Brunswick, N. J., Bul. 681, May 1940, Selman A. Waksman.

"Experiments with New Electric Devices for Pasteurizing Soils," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 731, April 1940, A. G. Newhall.

"Soil Testing, Operation, Interpretation, and Application," Agr. Exp. Sta., State College, Pa., Bul. 398, April 1940, F. G. Merkle.

"Water and Soil Conservation Experiments at Spur, Texas," Agr. Exp. Sta., College Station, Tex., Bul. 587, July 1940, R. E. Dickson, B. C. Langley, and C. E. Fisher.

"The Cause and Nature of Overliming Injury," Agr. Exp. Sta., Burlington, Vt., Bul. 460, June 1940, A. R. Midgley and D. E. Dunklee.

"Agricultural Lime Law, Chapter 49 of the Code of Virginia, as Amended and Re-enacted by the Acts of the General Assembly, 1920, 1940," St. Dept. of Agr. and Immigration, Richmond, Va.

"Salinity Conditions in the Big Horn River During the Years 1938 and 1939," Agr. Exp. Sta., Laramie, Wyo., Bul. 240, July 1940, T. J. Dunnewald.

"Review and Discussion of Literature Pertinent to Crop Rotations for Erodible Soils," U. S. D. A., Washington, D. C., Cir. 559, June 1940, C. R. Enlow.

"Farms the Rains Can't Take," U. S. D. A., Washington, D. C., Misc. Pub. 394, 1940, Kenneth Davis.

"Influences of Vegetation and Watershed Treatments on Run-off, Silting, and Stream Flow," U. S. D. A., Washington, D. C., Misc. Pub. 397, July 1940.

"Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics, Fourth Report," U. S. D. A., Washington, D. C., Tech. Bul. 702, July 1940, K. T. Williams, H. W. Lakin, and Horace G. Byers.

"Relative Infiltration and Related Physical Characteristics of Certain Soils," U. S. D. A., Washington, D. C., Tech. Bul. 729, July 1940, G. R. Free, G. M. Browning, and G. W. Musgrave.

"Arsenic Distribution in Soils and Its Presence in Certain Plants," U. S. D. A., Washington, D. C., Tech. Bul. 732, July 1940, Kenneth T. Williams and Richard R. Whetstone.

"Use the Land and Save the Soil," U. S. D. A., Washington, D. C., 213934-40, June 1940.

"Erosion and Related Land Use Conditions on the Hell and Mud Creeks Demonstration Project, Mississippi," U. S. D. A., Washington, D. C., Erosion Survey 12, 1940, D. T. Webb.

Crops

¶ That Georgia tomato growers need in many instances to adopt improved methods of culture is brought out by Dr. H. L. Cochran, who estimates the average yield of all commercially grown tomatoes in the State is from slightly less than two to about five tons per acre. The average for the entire United States is somewhat higher. The use of up-to-date methods is essential to profitable tomato production, and Dr. Cochran, in his Experiment Station Bulletin 206, "Improved Methods of Tomato Production in Georgia," explains that, as a rule, the more a grower invests in good seed, good plants adapted to local requirements, good cultivation and fertilizer practices, the greater are his yields. The cost of growing an acre of tomatoes that produces a high yield, however, need not be very much more than the cost of growing a low yield, and the cost per ton of fruit will be reduced.

Care should be exercised in utilizing young plants that are stocky and properly hardened when they are set in the field. Those varieties that are adapted to the special purpose desired should be secured. Well-prepared, well-drained loams and sandy loams are the most desirable soil types for tomatoes, although there are other types that will produce good crops if properly managed. A fertilizer analyzing 6-8-6 is recommended. From 450 to 800 pounds per acre, depending on the soil, should be applied in the row and mixed with the soil a few days before planting, to be supplemented when the first cluster of fruit sets with 100 or 200 pounds of sodium nitrate, ammonium sulphate, or their equivalents in nitrogen.

Deep cultivation is discouraged at all times because of the resulting root pruning and breaking of the plants. Where available without much expense, irrigation will serve to increase the yields and occasionally prolong the picking season until frost.

Training and pruning, greenhouse tomatoes, harvesting, marketing, controlling diseases and insects are also discussed.

¶ "Horticulture at the Ohio Agricultural Experiment Station," Special Circular 60, exemplifies the latest constructive accomplishments in the field of horticulture, contributed by the Experiment Station staff under the guidance of Dr. J. H. Gourley. This is the ninth of a series of circulars with the aim to offer the reader concise statements of the horticultural work at this Station. The varied research embracing the art of growing fruits, vegetables, flowers, and ornamental plants covers a wide scope of problems, many of which are partially or wholly solved in these studies.

The contents of this publication report the varietal and breeding investigations of horticultural crops, information on spraying, fertilizer experimentation, monthly distribution of labor used in growing and harvesting fruit, mulching, propagation of ornamental plants, and a host of other topics of much value under Ohio farm conditions as well as those for other States.

"Forty-ninth Annual Report, January 1 to December 31, 1938, of the Agricultural Experiment Station of the Alabama Polytechnic Institute," A . Exp. Sta., Auburn, Ala.

"Factorial Design in Plant Nutrition Experiments in the Greenhouse," Agr. Exp. Sta., Fayetteville, Ark., Bul. 401, June 1940, Cecil H. Wadleigh and W. H. Tharp.

"Varietal and Cultural Experiments with Corn," Agr. Exp. Sta., Fayetteville, Ark., Bul. 402, June 1940, C. K. McClelland.

"Rice Variety Experiments in Arkansas," Agr. Exp. Sta., Fayetteville, Ark., Bul. 403, June 1940, Martin Nelson and C. Roy Adair.

"Citrus Culture in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 114, Jan. 1940, R. E. Caryl.

"Grape Growing in California," Agr. Ext. Serv., Berkeley, Calif., Cir. 116, April 1940, H. E. Jacob.

"Rural Progress in Delaware," Agr. Ext. Serv., Newark, Del., Bul. 32, May 1940, George L. Schuster.

"Learning to Live on Georgia Farms, 1939 Annual Report, Georgia Extension Service," Agr. Ext. Serv., Athens, Ga., Bul. 474, 1939.

"Improved Methods of Tomato Production in Georgia," Agr. Exp. Sta., Experiment, Ga., Bul. 206, Aug. 1940, H. L. Cochran.

"Cover Crops and Fertilizers for Georgia Peach Orchards," Agr. Exp. Sta., Experiment, Ga., Cir. 122, Sept. 1940, E. F. Savage.

"Bramble Fruits, Raspberries, Blackberries, Dewberries, How to Grow in Illinois," Agr. Ext. Serv., Urbana, Ill., Cir. 508, June 1940, A. S. Colby, H. W. Anderson, and W. P. Flint.

"Report of the Director for the Year Ending June 30, 1939," Agr. Exp. Sta., Lafayette, Ind., 1939.

"25 Years of Extension Work in Indiana," Agr. Ext. Serv., Lafayette, Ind., H. E. Young.

"4-H Club Work in Indiana," Agr. Ext. Serv., Lafayette, Ind., Ext. Bul. 243, Mar. 1940, Harry F. Ainsworth.

"Watermelon Production in Louisiana," Agr. Ext. Serv., University, La., Ext. Cir. 202, May 1940, Joe G. Richard and N. D. Morgan.

"Growing Winter Legumes in Louisiana," Agr. Exp. Sta., University, La., Bul. 318, June 1940, Franklin L. Davis, C. G. Hobgood, and C. A. Brewer, Jr.

"Annual Report for the Fiscal Year Ending November 30, 1939," Agr. Exp. Sta., Amherst, Mass., Bul. 369, Feb. 1940.

"Lawn Management," Agr. Ext. Serv., Amherst, Mass., Leaf. 85, June 1940, Lawrence S. Dickinson.

"Legumes for Crop Production in the Yazoo-Mississippi Delta," Agr. Exp. Sta., State College, Miss., Bul. 345, July 1940, Roy Kuykendall.

"The Land Grant College Movement," Agr. Exp. Sta., Columbia, Mo., Bul. 419, July 1940, Frederick B. Mumford.

"Fifty-third Annual Report of the Agricultural Experiment Station," Agr. Exp. Sta., Lincoln, Nebr.

"Amount of Underground Plant Materials in Different Grassland Climates," Univ. of Nebr., Lincoln, Nebr., Conservation Bul. No. 21, May 1939, S. B. Shively and J. E. Weaver.

"Sorghum Production in Nebraska," Agr. Exp. Sta., Lincoln, Nebr., Bul. 329, June 1940, R. L. Cushing, T. A., Kiesselbach, and O. J. Webster.

"Legume and Grass Silage," Agr. Ext. Serv., Lincoln, Nebr., Ext. Cir. 147, June 1940.

"Serving New Hampshire Farms and Homes, Annual Report of the Director of the New Hampshire Cooperative Extension Service for the Year 1939," Agr. Ext. Serv., Durham, N. H., Ext. Bul. 58, June 1940, J. C. Kendall, Dir.

"Agricultural Research in New Hampshire, Annual Report of the Director of New Hampshire Agricultural Experiment Station for the Year 1939," Agr. Exp. Sta., Durham, N. H., Bul. 319, June 1940, M. Gale Eastman, Dir.

"Experiment with Potatoes," Agr. Exp. Sta., Durham, N. H., Bul. 324, June 1940, Ford S. Prince, Paul T. Blood, W. H. Coates, and Thomas G. Phillips.

"Studies of Pasture Management," Agr. Exp. Sta., Durham, N. H., Bul. 326, June 1940, Max F. Abell.

"Sixtieth Annual Report of the New Jersey State Agricultural Experiment Station and the Fifty-second Annual Report of the New Jersey Agricultural College Experiment Station for the Year Ending June 30, 1939," Agr. Exp. Sta., New Brunswick, N. J.

"Twenty-fourth Annual Report of the New Jersey State Department of Agriculture 1938-1939," St. Dept. of Agr., Trenton, N. J., Dec. 1939.

"Managing the Orchard," Agr. Ext. Serv., State College, N. Mex., Ext. Cir. 168, Feb. 1940, A. B. Fite and F. F. Whitley.

"The Morphology of the Apple and Other Pome Fruits," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Memoir 230, April 1940, L. H. MacDaniels.

"1. Factors in Soybean Production. 11. Variety Recommendations and Characteristics," Agr. Exp. Sta., Raleigh, N. C., Agron. Inform. Cir. 126, Aug. 1940, R. L. Lovvorn.

"Wheat Varieties for North Carolina," Agr. Exp. Sta., Raleigh, N. C., Bul. 328, Aug. 1940, G. K. Middleton, W. H. Chapman, J. W. Hendricks, and D. W. Colvard.

"Grasses," Agr. Ext. Serv., Fargo, N. Dak., Conserv. Series 20M-2-40.

"Horticulture at the Ohio Experiment Station, Wooster, Ohio," Agr. Exp. Sta., Wooster, Ohio, Sp. Cir. 60, Aug. 1940.

"Fifty-second Annual Report, Rhode Island State College Agricultural Experiment Station," Agr. Exp. Sta., Kingston, R. I., Contrib. 574, 1940.

"The Cotton Contest—1939, for Better Yield and Staple Value," Agr. Ext. Serv., Clemson, S. C., Cir. 182, May 1940, H. A. Woodle and B. E. G. Prichard.

"Pecan Production," Agr. Ext. Serv., Clemson, S. C., Cir. 185, May 1940, E. H. Rawl and W. C. Nettles.

"Spring Wheat Varieties in South Dakota," Agr. Exp. Sta., Brookings, S. Dak., Bul. 342, June 1940, S. P. Swenson.

"Elements of Life, a Study of the Effect of Mineral Differences on Soils, on Plants, on Animals, on Living Conditions," Agr. Exp. Sta., Knoxville, Tenn., Popular Bul. 1, June 1940.

"Composition and Utilization of Range Vegetation of Sutton and Edwards Counties," Agr. Exp. Sta., College Station, Brazos County, Tex., Bul. 586, June 1940, G. S. Fraps and V. L. Cory.

"The Conservation of Alfalfa, Timothy, and Soybean Nutrients as Silages and as Hays," Agr. Exp. Sta., Burlington, Vt., Bul. 459, June 1940, J. A. Newlander, H. B. Ellenberger, O. M. Camburn, and C. H. Jones.

"Livestock Poisoning by Oat Hay and Other Plants Containing Nitrate," Agr. Exp. Sta., Laramie, Wyo., Bul. 241, July 1940, W. B. Bradley, H. F. Eppson, and O. A. Beath.

"Production of Hops," U. S. D. A., Washington, D. C., Farmers' Bul. 1842, Feb. 1940, G. R. Hoerner and Frank Rabak.

"The Uses of Alfalfa," U. S. D. A., Washington, D. C., Farmers' Bul. 1839, June 1940, H. L. Westover and W. H. Hosterman.

"Market Quality and Condition of California Cantaloups as Influenced by Maturity, Handling, and Precooling," U. S. D. A., Washington, D. C., Tech. Bul. 730, July 1940, W. T. Pentzer, James S. Wiant, and John H. MacGillivray.

Economics

¶ Unemployment is not confined to the urban areas where machines are constantly increasing the output per worker in factories. There is an ever-increasing stream of agricultural workers being released from farms each year as our farm technology offers newer and improved methods of agricultural production. In order to provide some suggestions for meeting this technical progress, a report was prepared by 109 economists and technicians of the U. S. Department of Agriculture and published under the title of "Technology on the Farm." Our attention dwelled on that part of the report dealing with the outstanding recent developments and those which are to come in the not too distant future. The speed with which the improvements in our farm technique have taken place was brought to mind by the fact that in the past few decades more important farm machines were produced than in the previous four centuries. Today in place of horses and mules we have tractors of practically all sizes and designs to meet almost any farm requirement. In the past few years the development of the baby combine or midget combine harvester-threshers has extended the use of these machines to the smaller farm units where heretofore it was considered impractical to use the large cumbersome machines.

The writers of the report are of the opinion that the most outstanding mechanical developments in the next 10 years or so will include a continued trend toward small tractors, the greater use of pneumatic tires on tractors and other farm machines, and the further adaptation of complementary equipment to tractor power, coupled with about a 30 per cent expansion in tractor use.

They anticipate that about 500,000 more tractors will soon be in use on American farms, and that this will result in an additional displacement of about 1,500,000 horses and mules. To date it is estimated that tractors have replaced 10,000,000 head of work stock. We are inclined to sigh at the thought of the passing of these traditionally reliable beasts of burden, but then they tell us that sentiment has no place in economic progress and must be sacrificed as a part of the price of efficiency. Such displacement of work stock will release an additional 6,000,000 to 8,000,000 acres of crop land and approximately 6,000,000 to 7,000,000 acres of hay and pasture land for which a place must be found in our changing agricultural economy. Considering the current balance between farm production and consumption in America, we wonder what is to become of the products from these millions of acres which must enter the channels of trade in order to provide purchasing power to buy fuel and oil for these new mechanical brutes.

Among the many outstanding developments in plant breeding in recent years have been the development of hybrid corn and its astonishing advance in the corn belt. It is expected that 80% to 85% of the corn in the corn belt and probably 40% of the crop elsewhere will be from hybrid seed by 1950. At the present time approximately 24,000,000

acres of hybrid corn are grown in the corn belt States.

Soybeans are another comparatively new crop in this country, but have increased in importance tremendously and production may reach 100,000,000 bu. a year, in the near future.

The cost of producing agricultural products is being constantly lowered due to the improvement in the technique of production, developments of improved varieties of crops, improved methods in the breeding of livestock, better understanding of the food requirements of crops and livestock, which theoretically should mean a better standard of living for all of us. Unfortunately the problem is not as simple as it might seem; in fact the benefits of technological development are so questionable at the present time that there are two rather distinct schools of thought on the subject. One is that unemployment resulting from technology is largely temporary and is usually followed sooner or later by new and increased employment engaged in the production of other products, and that agriculture is primarily a business the same as any other in which all possible efficiency should be realized. The other view contends that technology brings permanent unemployment and enlarges our relief group and that the social gains derived therefrom are very doubtful. Thus the fundamental way to relieve the adverse effects is to retard the adoption of mechanized agriculture.

It must be admitted, however, that it is practically an impossibility to segregate social progress from technological progress. Technology has played a major part in raising the standard of living of the American people. By cheapening means of production it has brought to consumers in this country conveniences and luxuries heretofore only available to a few. The biggest problem at the present time arises from the fact that deficiencies in distribution apparently have not kept pace with technological progress in production and the benefits have not been distributed equally among all groups.

"Shipments of Various Fertilizers in Arkansas by Counties During the Fiscal Year Ending June 30, 1940," St. Dept. of Revenues, Little Rock, Ark., 1940.

"Second Annual Report of the Arizona Fertilizer Control Office, Year Ending December 31, 1939," Agr. Exp. Sta., Tucson, Ariz., Bul. 169, Feb. 15, 1940, W. T. McGeorge, E. O. Foster, and R. D. Taylor.

"Commercial Fertilizer Sales as Reported to Date for the Quarter Ended June 30, 1940," St. Dept. of Agr., Sacramento, Calif., Bu. of Chem. An. FM-8, Sept. 28, 1940, Dr. Alvin J. Cox.

"An Economic Study of Land Utilization in Kent County, Delaware," Agr. Exp. Sta., Newark, Del., Bul. 224, April 1940, R. O. Bausman.

"Cost of Producing Celery on Everglades Organic Soils, Seasons 1937-38 and 1938-39," Agr. Ext. Serv., Gainesville, Fla., Celery AE 2, May 1940, R. H. Howard.

"Types of Farming in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 342, Revised, July 1939, Lynn Robertson, E. C. Young, and H. J. Houk.

"Relation of Character of Farming Units to Land Management in Two Townships in Indiana," Agr. Exp. Sta., Lafayette, Ind., Bul. 450, Aug. 1940, J. R. Hays.

"Official Report, Commercial Fertilizers, Commercial Feeds, and Agricultural Liming Materials," St. Inspec. Serv., College Park, Md., Control Series No. 175, Aug. 1940.

"County Fertilizer Data: Mixed Goods and Materials, July 1, 1939, through June 30, 1940," St. Dept. of Agr., Jackson, Miss., 1940.

"Markets and Prices for New Hampshire Berries," Agr. Exp. Sta., Durham, N. H., Bul. 321, June 1940, L. A. Dougherty.

"Studies in Economics of Apple Orcharding. 111. Study of Orchard Problems by the Budget Method of Analysis," Agr. Exp. Sta., Durham, N. H., Bul. 323, June 1940, H. C. Woodworth and G. F. Potter.

"An Economic Study of Farming in Tompkins County, New York, 1937," Cornell Univ. Agr. Exp. Sta., Ithaca, N. Y., Bul. 728, Mar. 1940, Philip A. Henderson.

"Fertilizer Sales by Grade in Order of Tonnage, July 1-December 31, 1939," St. Dept. of Agr., Raleigh, N. C., Mimeo., 1940.

"Farmers' Cooperative Marketing and Purchasing Associations in North Dakota," Agr. Exp. Sta., Fargo, N. Dak., Bul. 294, June 1940, W. L. Ettesvold.

"Planning Minimum Sized Farms for the Beadle County Area in Central South Dakota," Agr. Exp. Sta., Brookings, S. Dak., Bul. 341, Jan. 1940, James L. Paschal, Aaron G. Nelson, and Olav Rogeness.

"Farm Performance in North Central South Dakota, 1930-1939," Agr. Exp. Sta., Brookings, S. Dak., Bul. 343, June 1940, Max Meyers.

"Economics of Flue-cured Tobacco Farming," Agr. Exp. Sta., Blacksburg, Va., Tech. Bul. 66, April 1940, W. L. Gibson, Jr.

Soil Conservation

DURING the last several years the public has been made very conscious of the subject of soil conservation. The agricultural programs of the government are written around it, and the publicity given to soil erosion, dust bowls, and dust clouds blowing across the country so as to be noticeable in eastern cities has brought home to the city dweller as well as the farmer the importance of soil conservation. Almost everyone with a little thought will agree as to the fundamental importance of conserving our soils from the viewpoint of national and international security and prosperity. Too much in the past, however, the importance and significance of soil conservation have been overlooked, except by some thoughtful observers.

One of these observers was Hugh Hammond Bennett, Chief of the Soil Conservation Service of the U. S. Department of Agriculture, and he used his observations as the basis of his new book, "Soil Conservation" (McGraw-Hill Book Company, Inc. New York, 1939. $6.00). It would be difficult to imagine a more competent man to write on the subject. In addition to his own wide experience and knowledge, he has been able to draw on the vast resources of the large organization which he organized and of which he is head. The result is an inspiring book which treats of soil conservation, with principal emphasis on the agricultural phases.

In his opening chapters, Dr. Bennett develops the thesis that the control of the various types of erosion is the main problem in soil conservation. The influence erosion has had on past civilizations and nations is shown, and many will be surprised to find what a tremendous bearing it has had on history, an influence usually not recognized until centuries after it has taken its toll. The destruction erosion is causing in all parts of this country is described and illustrated. Much of this destruction, such as gullying, is easily recognized, but the action of sheet erosion by water and apparently moderate movement of soil by wind usually are overlooked. The effects of erosion in filling reservoirs, removing surprisingly thick layers of the fertile top soil, frequently necessitating an entire shift in the agriculture of a region, the large losses in plant nutrients, and the economic and sociologic disruptions caused by erosion are brought out.

The first part of the book is devoted largely to explaining the types of erosion and factors influencing them. Included in these are kind of soil, climate, slope of land, type of cover, or in the case of farm land, management. The latter part of the book treats fully with methods of controlling erosion, and benefits derived therefrom.

Effective Control Measures

The remarkable effectiveness of grass sods, winter cover crops, and forest cover in reducing erosion and the beneficial effects of using them in a rational system of farm management happily mean that soil conservation can be practiced without sacrificing immediate income to any extent, and the long-time return certainly will be great. The improvement in organic matter content of the soil, retention of plant-food nutrients from washing, and improved water-holding capacity of the soil, all will combine to improve the productivity of the soil. The reduction of food dangers and damage, utilization of otherwise waste land to produce lumber, increase in wildlife, and possibilities of increased diversification in farming are only a part of the benefits indirectly accruing from erosion control measures.

A feature of the erosion control

methods given in the book is their practicability. Dr. Bennett and his staff have worked out the problems presented under actual, practical conditions, although they feel that theory and research are important parts of their work, and the necessity of further fundamental research on some of the problems is stressed by the author.

Dr. Bennett's book is earnestly recommended to all interested in the agriculture of this country. To those concerned with problems of soil fertility and management, it is one of the most valuable and useful volumes that has appeared. It is written in a clear style, with no attempt to dramatize situations easily lending themselves to such treatment. The reader cannot help being impressed with the problems and their seriousness, due to the many instances described and strikingly illustrated.

Food and Feed to Share

(*From page* 22)

and providing adequate pasture and other feeds for them at all times, they find their farm business less at the mercy of seasonal hazards, and variations and fluctuations of the markets. They, like their ancestors before them, have always been able to make livestock farming give them a reasonable return on the investment and labor involved.

No matter to which group one belongs, he should produce some crops for feed and maintain at least the minimum amount of pasture. It may be a question of nicety of management of livestock and grazing land or livestock, young trees, and grass on the same area. In other instances it may be the legitimate competition of other crops.

TABLE II—COMPARATIVE QUANTITIES OF DIGESTIBLE NUTRIENTS PRODUCED PER ACRE*
Calculations based on average yield in southeastern States for the 10-year period, 1922–31

Feed crop	Yields per acre†		Total digestible nutrients	
	Concentrates	Roughages	Harvested	Grazed‡
Concentrates:	*Bushels*	*Tons*	*Pounds*	*Pounds*
Corn, ears	16	.....	792	.....
Barley	18	.80	1,200	.....
Oats	22	.85	1,089	.....
Wheat	10	.60	774	.....
Grain sorghums	14	.75	1,280	.....
Roughages:				
Alfalfa	.....	1.50	1,605	1,204
Lespedeza	.....	.70	742	557
Annual legumes	.....	.80	832	624
Johnson grass	.....	1.00	1,016	762
Cereal hays	.....	1.00	986	740
Corn stover	.....	.70	647	.....
Silage:				
Corn	.....	3.20	1,152	.....
Sorghum	.....	6.40	1,743	.....

* From "Feeding Farm Livestock," by Earl Wooddell Sheets.

† The percentages of grain and straw respectively are of the total crop yields as follows: ear corn 55, stover 45, oats 35, straw 65, barley and wheat 40, straw 60. The yield of silage is based on the assumption that 1 ton of silage will be obtained for each 5 bushels of corn it would produce.

‡ It is estimated that 75 per cent as much digestible nutrients are produced when pastured as when cut for hay.

Corn is our most valuable crop, being produced on more than 5,000,000 farms. Grown in a diversified farm program, it safeguards our food and feed supply.

Such considerations naturally divide the country into rather definite regions, so far as profitable livestock production goes.

Regions will be found in the same State, often in the same county, which are well adapted to the production of feeder and fat cattle, or either, depending upon the choice of the individual. Other regions will greatly excel in one, while still others may prove entirely unsuited to anything but mutton or wool production, or to swine, poultry, or dairy production, or combinations of these due to their nearness or distance to market, their cropping possibilities, and even the training, capability, and the inherited preferences of the farmers themselves. For, when every other condition for livestock farming has been met, we must still reckon with the matter of personal equations. We must have farmers who know or are willing to learn the business, who are sold on the idea, and who are making livestock production the balance wheel of their farm program.

The viewpoint of too many farmers each fall has been, "How much feed will I have to buy with the cotton, tobacco, wheat, corn, or money from any other one cash crop to carry my work stock or other farm animals and poultry until pasture comes in the spring?" Oftentimes the estimate and the amount purchased are insufficient, resulting in poorly nourished animals or additional purchases in the spring when prices are highest.

The viewpoint in reality should be, "How much land will I have to set aside and plant to different crops in order to produce the feed needed to properly maintain and support my livestock until the next harvest, with some to spare?", remembering that bulging granaries and haystacks are usually security for the farmer as well as for his livestock.

Farmers know from experience that the profits from most livestock enterprises over a period of years are largely dependent upon the efficiency with which their animals utilize pasture, dry and succulent roughages, and other feed crops and by-products. Those who carefully plan their feed budgets annually in advance are those who are seldom without feed. While the annual requirement may vary somewhat with the different classes of animals and the

location in which they are produced, the amounts usually required will be approximately as shown in Table I.

More efficient livestock, with more feed units per acre of crop land, is the goal of the successful stockman and farmer. The wise farmer knows that when he increases the yield of nutrients per acre without proportionately increasing the cost, his chances for greater profits from his livestock enterprise have likewise been increased. The yields of nutrients per acre of the common feed crops, as shown in Table II, represent the actual yields for the southeastern States over a 10-year period. The yields are much lower than would satisfy most good livestock farmers, thus affording ample opportunity to make substantial increases by good farming methods, selection of crop or variety, and by using fertilizers and otherwise building up the fertility of the soil.

TABLE III—FERTILITY VALUE OF FARM FEEDS*

The fertility or manurial value of one ton of the principal farm feeds is based upon the following prices per pound for the essential plant-food elements which they contain: nitrogen, 20 cents; phosphoric acid and potash 5 cents

One ton	Value			Total fertility Value†
	Nitrogen	Phosphoric acid	Potash	
Concentrates:				
Corn	$6.00	$.21	$.31	$6.52
Corn and cob meal	5.24	.23	.14	5.61
Cottonseed meal	26.80	1.19	1.98	29.97
Dried brewers grains	16.40	.47	.05	16.92
Gluten meal	16.88	.55	.54	17.97
Hominy feed	7.04	.57	.60	8.21
Linseed meal	24.64	.86	1.27	26.77
Oats	7.68	.33	.40	8.41
Soybean oil meal	28.96	.66	2.20	31.82
Tankage	39.24	3.42	.55	43.21
Wheat bran	10.12	1.32	1.24	12.68
Wheat middlings	10.88	.72	.89	12.49
Roughages:				
Alfalfa hay	9.40	.21	2.02	11.63
Clover hay	7.56	.18	1.58	9.32
Corn silage	4.08	.18	1.18	5.44
Corn stover	3.64	.08	1.50	5.22
Cottonseed hulls	2.48	.10	.94	3.52
Johnson grass hay	4.16	.26	1.22	5.64
Lespedeza hay	8.22	.19	.84	9.25
Mangels	.88	.03	.36	1.27
Oat hay	5.23	.17	1.09	6.49
Oat and pea hay	7.80	.20	1.36	9.36
Oat straw	2.56	.13	1.66	4.35
Oat and vetch hay	8.00	.22	1.69	9.91
Pea vine hay	9.52	.22	1.03	10.77
Sorghum fodder	.96	.05	.36	1.37
Sorghum silage	.96	.04	.37	1.37
Soybean hay	9.48	.25	.82	10.55
Sweet potatoes	1.40	.05	.45	1.90
Timothy hay	3.96	.16	1.36	5.48

* From "Feeding Farm Livestock," by Earl Wooddell Sheets.

† It would be expected that at least one-half of the total fertility value of a feed fed to farm animals could be saved and returned to the land.

From the estimated yields, together with the budget requirements for the different classes of farm animals, the stockman should be able to plan his feeding operations well in advance to very great advantage.

Soils are depleted of their fertility through a number of agencies, but chiefly by erosion, improper farming methods, and continual cropping—if any products whatever are removed and not returned to the soil. The problem of permanent soil fertility is not the removal of less plant food, in fact, it is the removal of more plant nutrients through larger crops, made possible by the return of as much or even more plant food annually than has been taken away.

More than 90 per cent of all crops grown are utilized by livestock. When crops are sold from the farm where they are produced, the amounts of fertility as indicated in Table III are lost to the farm, and must be made up through the purchase of plant nutrients in some other form. When crops are kept on the farm and fed to farm animals, only one-third to one-fourth of this amount is lost, requiring only about one-fourth as much fertilizer to maintain the balance of fertility for maximum crop yields.

Research in Potash Since Liebig

(*From page 9*)

could be closely approximated by a chemical extractant and now has provided us with the quick test which, correlated with the Neubauer and the field tests, affords a most convenient method of diagnosing soil requirements. These methods are now in wide use, and in several States laboratories are operated to provide free soil-testing services on the State-wide basis under official auspices. This has been followed by chemical tests applied to plant juices, the tissue tests, of great usefulness particularly in checking soil tests, observations of deficiency symptoms, and plant response. This is now being followed by the quantitative analysis of plant tissue, applied particularly to the leaves of fruit trees where a definite correlation is being found between the potash content of the leaf and the economic performance of the tree.

Thus, at the end of a 100-year period since Liebig, it appears that we are completing a cycle, returning to plant analysis, the point at which Liebig started —logically, for after all it is the plant itself that must decide, in terms of its own requirements and not of our preconceived ideas.

Through the combined efforts of many generations of these biochemists, soil chemists, and agronomists, much is now understood about the function of the element, potassium, in plant life; yet much remains to be learned as to the details of the intricate reactions which constitute the related biological phenomena.

First, as a constituent of the soil solution, the potassium ion influences mutually the rate of intake of other mineral elements, in that respect playing a dominant role, itself entering the plant frequently in greatest amount and advantageously regulating the intake of others.

In the soil, potassium chloride has a marked effect on the intake of phosphorus, especially that from the less soluble forms, as shown by the Neubauer tests. Of 22 forms of phosphates so tested, the average increase due to the presence of potassium chloride was 16% (from 67% to 83%) on the basis of mono-calcium phosphate equaling 100%. This effect is ascribed to an increase in the availability of the phosphate, as soil reaction, which seems to find support in the fact that the availability of the less-soluble phosphates is likewise increased, the average of 10

forms of phosphates of this class, various forms of raw rock, showing an increase of 3% (from 8% to 11%) in availability as compared to 5.2% (from 26.8% to 32%) for mono-calcium phosphate.

Entering the root, potassium helps to maintain the outer cytoplasmic layer in the root cell in a condition which favors the optimum intake of soil water and, translocated to the plant leaf, it retards transpiration. It thus wields a marked influence on the water economy of the plant, thereby rendering it more resistant to drought and frost damage, both of which involve a dehydrating effect.

Influences Vital Processes

It is now generally recognized that potash is essential in all cell metabolic processes. It influences respiration and transpiration which are dependent upon supplies of CO_2, O_2, and H_2O. Without entering into known permanent chemical composition with other plant constituents, it operates in some essential manner in the synthesis of biological components and their translocation throughout the plant. These components comprise sugar, starch, cellulose, oil, protein, chlorophyll, enzymes, and vitamins. It thus appears to act in a manner somewhat analogous to the chemist's catalyst. It is radioactive, the only radioactive plant constituent. This property has suggested its function as being to supply radiant energy, supplementing in some vital manner the energy derived from sunlight—a suggestion not supported by closer analysis.

Potassium thus favorably influences all the vital processes which combined constitute the plant's life cycle and the purposes for which the plant is grown.

These effects translated into practical results show up in many ways of special interest to the man who grows crops as a livelihood, and combined constitute the economic foundation for the use of potash in agriculture. The development of cellulose and lignin tissues (xylem) gives strength and substance to the plant, enabling it to stand upright in the sunlight, thus preventing lodging. In addition, in the corn plant it prevents the accumulations of iron in the joint tissues of the stem. These accumulations interfere with the movement of plant foods to nourish the roots. The roots are weakened and become susceptible to root rots. Thereby potassium again prevents lodging. Promoting protein development, it increases the nutritive value of provender, and where the supply is sufficient contributes to the establishment and maintenance of legumes with their nitrogen-fixing capacity.

Potash increases the starch content of the grains, making plump kernels, and the sugar content of fruits and beets. It increases the thickness of the epidermal layer of cells, adding to plant resistance to disease and insect damage and to the shipping and keeping qualities of thin-skinned fruits and vegetables. It delays senescence, enabling the plant to reach full maturity.

Proper Ratio Important

In the case of tobacco, where quality exceeds yield in importance, those properties which are required by the buyer who offers the higher price depend on a high potash content of the leaf. Recent researches disclose in this instance the importance of a close ratio between nitrogen and potash in the leaf to provide the most favorable medium for the bacteria to whose activity the desirable aging processes are due.

In fact, it is now generally realized that there is an intimate inter-relationship between nitrogen and potash as plant foods, the presence of the potash in adequate quantity making it possible for the plant to utilize its nitrogen supply to best advantage, and vice versa. The plant intake of the two shows a remarkable correlation. Likewise, by the fact that when one is supplied in excess of the other (excess in terms of plant requirement), deficiency symptoms characteristic of the one present in inadequate amount promptly develop.

Thus potash deficiency in such cases

may be the result of nitrogen excess and vice versa. Such facts are the scientific basis for the nitrogen-potash mixtures in popular and growing use, particularly as deferred applications; it being recognized that the intake of both continues throughout the active life of the plant, and that with the exhaustion of the one or the other, the final result is poor yield or quality or both.

Potash deficiency inversely reveals itself by the absence of the desirable characteristics of plant and crop which the proper supply is expected to give. Extreme cases appear early in the life of the plant, due to the failure of the metabolic process above outlined. Tissue discolorations followed by dehydration and breakdown have now become easily recognizable on the principal crops, having been described, photographed in color, and widely publicized by the research agriculturist. The early recognition of these symptoms followed by prompt potash applications may now save a crop otherwise doomed to failure.

Perhaps the most striking instance of potash deficiency is that still all-too-frequently observed in cotton fields, where the potash-starved plants are completely defoliated in mid-season and their life-cycle ended with stunted growth, poor yield and quality of fiber, and partly opened bolls hard to pick, as contrasted with the properly fed plant still producing and maturing high-quality fiber to the end of the growing season.

The high potash requirement of legumes deserves emphasis, since those crops are an important element in the vast soil-conserving programs now in nation-wide operation. They are characterized by their large root system and their consequent ability to "forage" for their potash supply. Grown for their ability to acquire their nitrogen supply from the air, they are soil-building from the viewpoint of nitrogen and the cheapest form of organic ammoniates; but even when turned under for the benefit of succeeding crops, they add nothing to the total potash supply, and when removed from the field (as frequently happens), they are soil-potash-depleting crops of the first magnitude.

Potash Research Continues

Potash research inaugurated 100 years ago has continued up to the present time in ever-increasing volume, particularly in the agricultural field. Potash occupies the enviable position where its profitable use is the concern of that great army of research workers whose mission in life is the service of agriculture. In the United States in practically every State, potash research is being conducted to guide the farmer in its use. Its application has been found profitable on every commercial crop and in practically every area where those crops are grown. Liebig's contribution derives its significance from the unremitting endeavors of the many agricultural workers who have succeeded him during the past 100 years.

A Few More Good Men

(*From page* 12)

soil and crop conditions. They found lime and potash to be two of the very necessary fertilizing treatments, and Mr. Wilkinson says that this remains true today.

A great transformation has come over the country since the time when I first saw it back in 1913-14. The canals and ditches were just being dug and masses of roots, stumps, fallen trees, and other debris made it impossible to get onto the land with cultivating implements. Negro laborers went into this mass, and wherever they found an open spot, they stuck a hole with a sharpened stick and dropped in the corn kernels. Harvesting also was done by hand with the ears snapped and

brought to the nearest canal bank. Since that day, the land has been better cleared and the soft, dark soil is beginning to take on the appearance of old, cultivated land.

There are thousands of acres yet to be brought into complete cultivation, but all about near the canals are nice, rural homes with trees and the rectangular fields made so by the recurrent ditches. A great flowering bulb industry is being developed, and millions of scented blossoms are shipped each March.

A few of the settlers are adding beef cattle and dairy animals. I saw crimson clover and flourishing small grain, but in the main it is a region of corn and soybeans. It is a rich country with vast potentialities. Sam Wilkinson looks over it now with his background of 53 years of farming and says, "All we need are a few good men who know how to farm and are willing to work."

For years, "Mr. Sam" rode a small pony about over his farm, but increasing years caused him to change to a mule and buggy. He is out at daybreak each morning and rides about across fields and along ditch banks until noon. When the laborers have had their meal and have "caught out" again, he goes to his dinner, but his mule stands hitched and ready for him again at two o'clock, and then he is out until dark.

He hires 50 to 60 negro laborers in season to "weed" his onions, and others are used in the various cropping operations. He has his own siding and loading platform at the Wilkinson railroad station just in front of his home. The giant tubs in which his onions are pickled are there also. Despite his advanced age, he takes a keen and discerning interest in every farm operation and feels that he laid the foundation for the farming community which surrounds him. "Someday," he mused just as we were leaving, "this will be a great country. Just a few more good men. . . ."

Taking the Road Back to Soil Fertility

(*From page* 16)

on the farm, as in the Big Creek project as a whole, is Shelby silt loam, a fertile but highly erodible soil.

Back in 1934, when Anderson started his soil-saving program, he was faced with a serious erosion problem. From most of the fields, between one-fourth and three-fourths of the original topsoil had already been washed away. From portions of the farm all of the topsoil was gone, and the land was no longer profitable to farm. For years, Anderson had been fighting a losing battle with field ditches.

Root of the trouble, as Anderson now freely admits, was the use he had been making of his land. In 1933, for example, 103 of his rolling acres were planted to corn, a crop which provides virtually no protection for the soil. Less than 30 acres were protected by pasture, and what pasture he had was severely over-grazed. Twenty acres of land lay idle. And there was not an acre of hay or timber on the farm!

Accordingly, the first step was to rearrange completely Anderson's cropping system. This involved a shift from cash crop to general livestock farming, a shift which Anderson was glad to make, because it was obvious to him that his farm's productive days were numbered unless erosion were brought under control.

The acreage in cultivated row crops was drastically cut—from 103 to 13. A 5-year rotation consisting of corn, oats, and 3 years of alfalfa, clover, and timothy hay was established for all cultivated cropland. Thus, small grain acreages were increased from zero to 12 for the average year, and rotation hay acreages increased from zero to 32. The acreage in permanent pasture was

increased 2½ times—from less than 30 to approximately 77 acres. Some 8 acres of steep and severely eroded land were planted to trees for erosion control and wild-life management.

It can be seen that the revised cropping system keeps most of the "weak" acres "under wraps" most of the time, so that erosion has little chance to cut into the soil resources. Moreover, Anderson supplemented his cropping revisions with new soil-saving tillage methods. All of his cropland is now operated on the contour or level instead of in straight rows "up and down," so that now each crop row serves as a miniature dam or terrace cutting across the line of flow of run-off water, slowing it down, and thus causing more of it to soak into the ground. He built broad-based soil-saving terraces to protect 26 acres of cropland, he built diversion dikes and planted trees to heal up gullies, he limed and fertilized all of his crop and permanent hay land, and he instituted the practice of "rotational grazing" on all of his pasture land, so that over-grazing with its resulting "bare spots" would be avoided.

Result of the program is that Anderson can now use his soil profitably without using it up. He has placed his farm enterprise on a permanent basis by providing adequate safeguards for his soil assets. Erosion and run-off have been cut to a fraction of their former amounts. Studies conducted by Soil Conservation Service technicians reveal that, whereas formerly Anderson's net nitrogen loss from his soil was 5.38 per cent annually, it is now only 0.027 per cent—and soil fertility can be measured fairly accurately in terms of nitrates. Finally, the conservation program has resulted in a distinct improvement in Anderson's farm income.

The program on the Anderson farm portrays, in fairly accurate miniature, the program for the Big Creek project as a whole. The crop acreage of cooperating farmers has been cut from 59,000 to 40,000. The acreage in permanent hay has been increased to 6 times the former amount, from 2,400 to 17,000 acres. The acreage in pasture has been increased from less than 50,000 to more than 53,300. The acreage devoted to farm woodlots has been increased from 370 to 1,850.

Incidentally, farm woodlots can play a more important part in the individual farm economy than most people realize. A recent survey of 50 farms included in "cooperative agreements" in the Big Creek area revealed that the annual replacements for fences on the average farm required 45 posts having a market value of $8.40. All but 12 of the 50 farmers used wood exclusively for fuel, with each of the 38 farmers burning 16 cords of wood per year, on the average. Purchased on the open market, this amount of wood would cost the farmer $36.83. During the last 10 years, the average farmer has used about $5.50 worth of lumber each year for repairs, but this figure is low, because little repair work has been done during the "Depression Thirties". Altogether, the average farm in the area uses $52.74 worth of wood products annually. Most of these products can be produced on the farm, and, under the new conservation program, a much larger portion of them will be.

Soil-saving Practices

Important in the establishment of good soil-saving crop rotations was the application of lime on Big Creek farms. Practically all of the land in the area requires applications of 3 tons of lime per acre to overcome the soil acidity, which otherwise prevents the success of legume seedings. Some 75,000 tons of lime have been crushed by the Soil Conservation Service and spread over 25,000 acres of cropland in the project area. To see to it that lime and soil alike "stay put," contour or "around-the-hill" cultivation has replaced straight row tillage on most of the cultivated sloping acres, and 623 miles of broad-based terraces have been built to protect 9,400 erodible acres. Approximately 4,000 acres are protected by contour "strip cropping," whereby long slopes are planted to alternating strips of clean-

tilled and close-growing cover crops, and more than 6,000 acres will be so protected when the planned program is completed on all farms.

Introduction of contour tillage on slanting fields has been the most spectacular departure from traditional farming methods in the area. The ability to plow a straight furrow has long been considered one mark of a good farmer; hence, the growing acceptance of the new criterion of good farming, namely, the ability to plow a furrow which deviates less than 2 per cent from the "true" contour, is something of a psychological triumph for cooperating farmers and soil conservation technicians.

The demonstration farms prove conclusively that contour tillage saves soil and moisture. Every farmer who has tried "around-the-hill" cultivation has noted that erosion losses from his fields after heavy rains are small indeed compared to the soil losses from neighboring fields operated in the usual way. Moreover, many farmers have reported substantial increases in yields on newly contoured fields—increases which they attribute to improved soil moisture conditions.

A State-wide survey made by the Extension Service of the University of Missouri a year ago revealed that contouring boosted corn yields by 25 per cent, on the average.

It might be expected that the immediate result of the drastic revision in Big Creek farming methods would be a marked reduction in farm incomes, however beneficial the programs might be in the long run. This, however, has not occurred. Farm incomes have not declined. Indeed, they have increased, though credit for the increase cannot be given altogether to the conservation work.

Contour or "around-the-hill" farming protects soil against erosion. This field on the Carl Morris farm in the Big Creek watershed is both contoured and terraced. Big Creek farmers are taking the road back to soil prosperity.

The net income for the average cooperating farmer, as revealed through some 60 individual farm record books kept by farmers in cooperation with the University of Missouri, was $845 in 1935, $649 in 1936, $882 in 1937, and $1,199 in 1938. B. H. Frame of the Department of Agricultural Economics at the University of Missouri points out that this fluctuation in income is no greater than might normally be ex-

pected, and hence has little significance, except that it does indicate that establishment of conservation programs has worked no economic hardship on the farmers.

More significant is a comparison made between incomes from the "one-third farms with least erosion" and the "one-third farms with most erosion". The comparison, made in 1938 and based on farm account records, revealed that between 1935 and 1938 inclusive the average management return (distinguished from "labor income" and "interest on investment") was $107 from the one-third farms with least erosion as compared with $4.50 for the one-third farms with most erosion. In 1938, the gross value of all crops was $5.90 per acre for the average farm in the low erosion group, as compared with a value of $4.12 per acre for the average farm in the high erosion group.

From Grain to Livestock

Still more significant, from the long-time point of view, is the basic shift from grain to livestock farming in the Big Creek area. The manager of the Lamoni Cooperative Creamery at Lamoni, Iowa, has reported that the volume of cream obtained on cream routes lying inside the project area has increased 50 per cent over the volume obtained on routes outside the area. The creamery manager explained that in his opinion the increase in pasture-carrying capacities and the increased use of legume hay, both of which result from the conservation programs, are responsible for the increased production of cream. The manager also reported that, during periods of seasonal decline, the volume of cream declined 25 per cent more on routes outside the project area than on routes inside.

Farmers themselves are, for the most part, "happy about the whole thing." Evidencing their interest in soil conservation, Big Creek farmers have gone ahead to—

contract with a local quarry, through their local Soil Improvement Association, for the distribution of lime anywhere in Harrison County, Missouri, for $1.50 per ton; cooperate in at least one instance in the purchase of their own lime crusher and in crushing their own lime; cooperate in the purchase of fertilizer in carload lots at reduced rates; and hire private contractors to build earth dams and soil-saving terraces.

The farmers look forward confidently to a definite increase in farm productivity rather than a gradual decline. They know that now, for the first time on many farms, their agricultural enterprise is on firm footing. Their basic capital is not slipping out from under their feet with every heavy rain; they've placed their soil under lock and key.

The hundreds of people who visit the Big Creek area each year find in the demonstration a "window" through which they can glimpse the farm patterns of the future. They are given a preview of the farming practices which, in the not too distant future, must blanket millions of acres of erodible land in America, if a prosperous agriculture is to continue. They see curved rows bent gracefully around the slopes, terraces tying down wandering soil, greens replacing browns on thousands of acres where hay and grass have replaced small grain and corn.

A Successful Demonstration

More than 5,000 people, most of them farmers from Missouri and Iowa, have visited the demonstration since 1934. Many of them have returned to their own farms to apply the practices they have seen demonstrated. Thus the project has become a focal point for a spread of conservation farming methods.

Moral of the Big Creek story is that farmers on erodible land must adapt their farming patterns to the needs of the land—or else. The "or else" has been clearly indicated on the Soil Conservation Experiment Station, maintained at Bethany by the U. S. Soil Conservation Service and the University

of Missouri. The station, started in 1931, has had a great deal of influence on the program established, not only in the Big Creek area, but in scores of other areas throughout the country.

Plot studies there have shown that, by planting corn year after year in straight rows up and down an 8 per cent slope, farmers can give away to erosion the top 7 inches in just 15 years. Since the average depth of top-soil is considerably less than 7 inches in the Big Creek area, the "or else" part of the moral is obvious. Plant that same slope to a 3-year rotation of corn, wheat, and timothy and clover, and you increase the longevity of its top-soil to 114 years. But keep the slope in bluegrass or permanent legume hay and you increase its longevity to around 5,000 years, which means that you'll be giving nature a chance to build soil faster than erosion can wash it away!

Raw Materials for the Apple Crop

(*From page* 19)

is an economic one. It may be profitable in some cases and too expensive in others. It is safe to say that one can afford to spend more money on this sort of a program than on the more common methods of soil culture and fertilization, because it is a soil-building and not a soil-destroying program.

The practice of mulching orchards promotes soil building, not only because it is an effective means of checking soil erosion, but it seems as though it brings about conditions especially favorable to tree growth and fruit production. Trees grow vigorously but not excessively. The crop in the lighter crop year is better. Nutrient availability seems to be higher, and the supply of nutrients from an adequate mulch seems to be sufficient with little or no addition through direct fertilization of the trees, though the growing of the mulching material is likely to call for fairly liberal fertilization.

Any material that will suppress the growth of grass and weeds through spring and early summer is suitable for mulching. Waste hay is most commonly used. When straw is abundant it will do, but it should be remembered that it carries less plant nutrients. We have tried sawdust and found out two things: it has not injured the trees, and it requires a heavy application to suppress grass. We have not found out how much, but doubt if less than a foot would be effective. Neither straw nor sawdust seems equal to waste hay.

Provisions

(*From page* 5)

handsome queens of the billows went gracefully down the coast and around the gulf to New Orleans. In those thumping times when New England captains made their renowned passages to and fro, the *Louisiana Gazette* printed reams of advertising notices such as these:

"Sanderson & White, 150 bbls. beef from the cargo of ship *George Washington* from Newport, consisting of sheeting, cordage, cyder, New England rum and prime Conn. beef and hams."

"John Poultney & Sons—Cargo landing from the brig *Mentor* from Philadelphia—Jersey lard, 20 tubs saltpetered rounds of beef, 15 half bbls. ditto, and mess pork."

"Alex Milne—80 bbls. beef, 50 bbls. prime pork, three prime negro women and Holland gin."

It appears that the canny Scots of the coastwise trade dealt sometimes in variegated merchandise, some of it none too

savory, at least if judged on the moral preachments of the Puritans.

Beginnings of the corner grocery and general store, later transplanted, with more or less improvement and local adaptation, from the greenswards of the Bay State to the virgin hamlets of the Midwest, are noted thus:

"Warner & Colt will buy rye, oats and barley, flannel socks, pork, and mittens, in exchange for rum and brandy and elegant landscape paper hangings."

WE fear that some of the townsmen disposed of the fatted calf only to become so frivolous at holiday time over the bottled goods that the "elegant paper hangings" only made them dizzier.

Still we follow the westward expansion along the Erie Canal a decade later to read advertisting by merchants who wanted to supply canal and river boats with provisions at reasonable rates. These appear notably in the Cayuga *Republican* and the Buffalo *Journal.*

One of the earliest examples of rival advertising to get consumer trade in meat products appears in the Philadelphia *Democratic Press* of January 1, 1824. David & Adam Woelpper at No. 42 High Street Market offered superior beef against the "grand display of mutton" sold by Samuel Greer, Shambles 17 to 23, High Street Market. The former had bought 42 head of oxen from George Sheaff of Montgomery County, "which for size, neatness, fatness and flavor excel anything ever before set before the public." Mess beef by the barrel was quoted at twelve dollars, prime at nine, and rounds at four dollars per forty-pound tub.

Greer & Co. told the readers of the press that their Merino sheep were from Robert Clemens, together with others from Mr. Evans of Chester County, the latter Bakewell type. "The choicest pieces of these well fed sheep will be sold at six and a quarter cents a pound. Come singly or come in pairs, or by the dozens, we shall have knives and cleavers enough to serve you all."

Men ate their pork salty and drank their bitters straight in the brave days of "the famous" old Ohio River packet fleets, when Cincinnati loomed as the Porkopolis of America. Reams of food advertising are seen in musty issues of the *Maumee River Times,* the Steubenville *Herald,* the Cincinnati *Columbian,* and the Akron *Beacon.* At least one firm then advertising as dispensers of lard, oil, and tallow candles has survived the years as Procter & Gamble.

John Plankinton, located at Milwaukee in 1851, advertised his butcher shop with a mammoth ox weighing 2,142 pounds, six years old, fed by J. Holden of McHenry County, Illinois. Early packing house names among the files of Chicago papers of the 1830's are those of retail and wholesale provisioners such as Gurdon S. Hubbard, Sylvester Marsh, and George W. Dole. They led the van among those who stole the spotlight from Cincinnati and transferred it to Illinois.

AFTER the Civil War clouds rolled away, the most important event reflected in the advertising columns of the Chicago press was the grand opening of the Union Stock Yards and Transit House, December 25, 1865. Folks were moving west and taking their best droves along, the cities of the plains were building up after the dreary wartime interval, and a new spirit of enterprise and expansion sharpened men's appetites and enabled Chicago to become the fountain head of provisions for a century. No doubt there were hungry people who never got enough to eat even in those boastful days, but somehow such facts did not crowd into the newspapers or become political issues.

Indeed, we seemed to have developed a surplus away back in the seventies, so that American packers and exporters boasted that they had founded a successful British trade in refrigerated provisions, with stalls in the Smithfield Market, London. Advertising which emphasized these American food products

was found in the dull columns of the London *Times* for 1876 and 1878. Canada and the Argentine had not then crowded us away from the empty bellies of Great Britain.

In the earlier advertising of provisions, consumers were impressed with bulk and price values. They bought for large families and bought generously, not hand-to-mouth and by package as now. Beginning about 1880 the phase of national advertising by brands takes precedence over the old methods of barrel and tub meat sales. Armour, Ferris, and Liebig seem to be the provisioners most fluent and fervent as well as frequent, and the scene changes from local newspapers to sectional and national magazine displays. Soups, mincemeat, meat sauces and garnishes, leviled hams and extract of beef dominate the advertising columns until 1900 or thereabouts. Soon thereafter the invention of better engraving and printing processes and the rise of the advertising agency and its consumer studies combined to instil the food fraternity with a competitive orgy of color, design, and tasty effects.

PLATES garnished with meat so vividly pictured that one gets whiffs of aroma and the watering of the mouth gazing on them; steaming hams done to a turn and peppered with cloves; beautifully set dinner tables groaning with goodies—the very juice and essence of gastric perfection were printed by the successors of old Ben Franklin, Postmaster Campbell, and Edes & Gill.

Yet one more addition must be noted in the unfolding scroll of appetite-appealing literature. Prior to the 1900's one might scan public prints in vain for much mention of fruits, fruit juices, vegetables, or dairy products. Folks were hard livers and ravenous eaters, but they wanted steaks, roasts, stews, and lots of fish and fowl, and quantities of fats, greases, and gravy to keep up steam. Thanksgiving was a long-planned, serious, many-sided affair, and as nobody wanted to take an auto ride after meal time to see the football game, there was no objection to gobbling, dish-washing, and snoozing as the chief pleasures of the day.

But since the era of moderate eating and varied dieting has intervened to save us from ourselves, we see the rise of widely advertised tropical fruits and northern fruit and berry juices and sauces; and the mammoth dairy industry has swamped the nation with assortments of delicacies and desserts; while the vegetable business has climbed to take its place alongside the butcher and the packer in popular favor. Funny after all, that while we eat less than ever per capita, we have more offered us, and an endless variety of new ways and better reasons for coming to the table.

SOMEBODY told me the other day that he believed the peacetime draft of soldiers for training and the defense program together would combine to cause more and better eating. This may be explained perhaps by two sentences. First, the young men placed in army camps are going to exercise more thoroughly, put in longer outdoor hours, and have as good or often better balanced meals than they got at home. The defense program itself will employ more men and women at profitable wages and enable them to supply their homes with a greater variety of vitamin-laden foods.

But arm as we may, hire as we will, the good old skillful American farmer will more than keep step with the bigger demand. And there will be countless hungry folk left besides, who would count a crust and a sop a generous dinner. There is no room for doubt that our social obligations must keep pace with our knowledge in nutrition and our ability to produce. Giving every child a right to grow well and keep fit is our greatest domestic goal.

Don't heckle me for being a political spellbinder. The only ticket I ever ran for is the square meal ticket, and I hope you'll get elected on it too.

Try Next Door

Book Agent: "Have you Charles Dickens in your house?"

Housewife: "No!"

Book Agent: "Or Robert Louis Stevenson, or Walter Scott?"

Housewife: "No, we ain't. What's more, I don't take in boarders. Try next door, they do."

"Sugar Pie," said the dark swain, "did that kiss Ah just gave you make you long fo' another?"

"Sho did, Boy, h'it sho did! But he's outa town."

"What are you doing at a Klan meeting, Ikey—you can't join."

"I don't want to join, I want to talk to the fellow that buys the sheets and pillow cases."

Life is just an everlasting struggle to keep money coming in and teeth and hair and vital organs from coming out.

No Sound Effects

"Painter, are you working?" she called for the third time, from the foot of the stairs.

"Yes, ma'am," the painter replied.

"I can't hear you working."

"Good night, ma'am," he exploded, "did you think I'd be putting it on with a hammer?"

First Co-ed: "Jimmy is grand, but I think all men are trying sometimes."

Second Co-ed: "All the time, dearie, all the time."

Fall is that particular time of the year when the political pot boils over and we get the old familiar odor of applesauce.

Wife—"You've been drinking."

Hubby—"I have not."

Wife—"Then what are you doing with that sign on your hat—'This Side Up With Care?'"

Does Her Share

Bargaining for a cow had gone on at a leisurely pace for more than an hour. Finally the prospective buyer came flatly to the point.

"How much milk does she give?" he asked.

"Wal," said the farmer, "I don't rightly know—ain't never measured what Prunella gives, to be truthful. But she's good-natured—she'll give all she can."

Two little boys stood on the corner. A little girl passed by.

Said One: "Her neck's dirty."

Said the Other: "Her does?"

"So you have been married before, Mrs. Riley?"

"Yus' ma'am, three times; and if it pleases 'eaven to take this one, too, I know where I can lay me 'ands on a fourth."

FERTILIZER *Films* AVAILABLE

WE ARE NOW PREPARED TO LOAN without charge to agricultural colleges and experiment stations, county agricultural agents, vocational teachers, responsible farm organizations and members of the fertilizer trade, several films bearing on the proper use of fertilizers, particularly potash. *Anyone interested in showing these films should direct their requests to our Washington office.*

Potash in Southern Agriculture

Covers fertilization and potash deficiency symptoms of cotton, tobacco, and corn in the various States of the South. Depicts experimental work now in progress at several Experiment Stations, also crops in the field, fertilizer placement work, and scenes in a fertilizer factory.

16 mm.—sound, color—running time 20 min.

Projectors will be loaned where necessary.

Potash From Soil to Plant

Sampling and testing soils to determine fertilizer needs, effects of potash deficiency on prunes, grapes, and Ladino clover in California.

16 mm.—silent, color—running time 40 min. (on 1600 ft. reel).

Condensed edition, omitting scenes on prunes and grapes, on 400 ft. reel, running time 15 min.

Please indicate size of reels desired.

Potash Deficiency in Grapes and Prunes

Effects of potash deficiency and fertilizer treatments on grapes and prunes in California. Typical nutrient deficiency symptoms and recovery due to corrective fertilization shown.

16 mm.—silent, color—running time 15 min. (on 400 ft. reel).

Bringing Citrus Quality to Market

Shows influence of fertilizers, particularly potash, on yield and quality of citrus fruit. Quality factors include thickness of rind, volume of juice, weight and general appearance of fruit.

16 mm.—silent, color—running time 25 min. (on 800 ft. reel).

Machine Placement of Fertilizer

Covers methods of applying fertilizer to California orchards, lettuce, and sugar beets. Shows scenes of various types of apparatus devised by growers for applying fertilizer in orchards and on row crops.

16 mm.—silent, color—running time 15 min. (on 400 ft. reel).

New Soils From Old

This film was prepared for the Department of Agronomy, University of Illinois. Deals with the experimental work on Illinois Soil Experiment Fields and stresses the benefits from a balanced soil fertility program using limestone, phosphates, and potash in growing corn, wheat, clover, and other crops.

16 mm.—silent, color—running time 40 min. (on both 400 and 1600 ft. reels).

Please indicate size of reel desired.

Fertilizers Improve Midwest Crops

Shows effects of proper fertilization on the growth of corn, wheat, alfalfa, and other crops in Illinois, Indiana, and Iowa. Includes potash, phosphorus, and nitrogen starvation symptoms and their confirmation by chemical tissue tests.

16 mm.—silent, color—running time 40 min. (on both 400 and 1600 ft. reels).

Please indicate size of reel desired.

Requests for these films should include information as to group before which they are to be shown, date of exhibition, and period of time of loan.

AMERICAN POTASH INSTITUTE, INC.

Investment Building **Washington, D. C.**

Printed in U. S. A.